Table of Contents

[TABLE OF FIGURES 3](#_Toc219797849)

[LSTM (baseline for comparison) 8](#_Toc219797850)

[Result of Full Features 8](#_Toc219797851)

[Result of Filtered Features 8](#_Toc219797852)

[PatchTST (baseline for comparison) 8](#_Toc219797853)

[Result of Full Features 8](#_Toc219797854)

[Result of Filtered Features 8](#_Toc219797855)

[iTransformer (baseline for comparison) 9](#_Toc219797856)

[Result of Full Features 9](#_Toc219797857)

[Result of Filtered Features 9](#_Toc219797858)

[LSTM + Vietnamese Embedding 9](#_Toc219797859)

[Results 9](#_Toc219797860)

[Cross-Attention Fusion 9](#_Toc219797861)

[Concatenate Fusion 11](#_Toc219797862)

[LSTM + Vietnamese Document Embedding 13](#_Toc219797863)

[Results 13](#_Toc219797864)

[Cross-Attention 13](#_Toc219797865)

[Concatenate Fusion 15](#_Toc219797866)

[PatchTST + Vietnamese Embedding 17](#_Toc219797867)

[Results 17](#_Toc219797868)

[Cross-Attention 17](#_Toc219797869)

[Concatenate Fusion 19](#_Toc219797870)

[PatchTST + Vietnamese Document Embedding 21](#_Toc219797871)

[Results 21](#_Toc219797872)

[Cross-Attention 21](#_Toc219797873)

[Concatenate Fusion 23](#_Toc219797874)

[iTransformer + Vietnamese Embedding 25](#_Toc219797875)

[Results 25](#_Toc219797876)

[Cross-Attention 25](#_Toc219797877)

[Concatenate Fusion 27](#_Toc219797878)

[iTransformer + Vietnamese Document Embedding 29](#_Toc219797879)

[Results 29](#_Toc219797880)

[Cross-Attention 29](#_Toc219797881)

[Concatenate Fusion 31](#_Toc219797882)

# TABLE OF FIGURES

[Figure 1: Test Set Results of LSTM Full Features 8](#_Toc219797783)

[Figure 2: Test Set Results of LSTM Filtered Features 8](#_Toc219797784)

[Figure 3: Test Set Results of PatchTST Full Features 8](#_Toc219797785)

[Figure 4: Test Set Results of PatchTST Filtered Features 8](#_Toc219797786)

[Figure 5: Test Set Results of iTransFormer Full Features 9](#_Toc219797787)

[Figure 6: Test Set Results of iTransFormer Filtered Features 9](#_Toc219797788)

[Figure 7: Validation Loss by Window Size and Training Curves of LSTM\_VN\_Emb\_CrsAtt 9](#_Toc219797789)

[Figure 8: Test Set Results of LSTM\_VN\_Emb\_CrsAtt 9](#_Toc219797790)

[Figure 9: Actual vs predicted closing prices (LSTM\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H = 1, 4, 7) 10](#_Toc219797791)

[Figure 10: Actual vs predicted closing prices on (LSTM\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H = 10, 14, 21) 10](#_Toc219797792)

[Figure 11: Multi-horizon stock price prediction on a test sample (LSTM\_VN\_Emb\_CrsAtt) 11](#_Toc219797793)

[Figure 12: Validation Loss by Window Size and Training Curves of LSTM\_VN\_Emb\_Concat 11](#_Toc219797794)

[Figure 13: Test Set Results of LSTM\_VN\_Emb\_Concat 11](#_Toc219797795)

[Figure 14: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Concat) across multiple forecasting horizons (H = 1, 4, 7) 12](#_Toc219797796)

[Figure 15: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Concat) across multiple forecasting horizons (H = 10, 14, 21) 12](#_Toc219797797)

[Figure 16: Multi-horizon stock price prediction on a test sample (LSTM\_VN\_Emb\_ConCat) 13](#_Toc219797798)

[Figure 17: Validation Loss by Window Size and Training Curves of LSTM\_VN\_Doc\_Emb\_CrsAtt 13](#_Toc219797799)

[Figure 18: Test Set Results of LSTM\_VN\_Doc\_Emb\_CrsAtt 13](#_Toc219797800)

[Figure 19: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Doc\_CrsAtt) across multiple forecasting horizons (H = 1, 4, 7) 14](#_Toc219797801)

[Figure 20: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Doc\_CrsAtt) across multiple forecasting horizons (H=10,14,21) 14](#_Toc219797802)

[Figure 21: Multi-horizon stock price prediction on a test sample (LSTM\_VN\_Doc\_Emb\_CrsAtt) 15](#_Toc219797803)

[Figure 22: Validation Loss by Window Size and Training Curves of LSTM\_VN\_Doc\_Emb\_Concat 15](#_Toc219797804)

[Figure 23: Test Set Results of LSTM\_VN\_Doc\_Emb\_Concat 15](#_Toc219797805)

[Figure 24: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Doc\_Concat) across multiple forecasting horizons (H = 1, 4, 7) 16](#_Toc219797806)

[Figure 25: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Doc\_Concat) across multiple forecasting horizons (H=10,14,21) 16](#_Toc219797807)

[Figure 26: Multi-horizon stock price prediction on a test sample (LSTM\_VN\_Doc\_Emb\_Concat) 17](#_Toc219797808)

[Figure 27: Validation Loss by Window Size and Training Curves of PatchTST\_VN\_Emb\_CrsAtt 17](#_Toc219797809)

[Figure 28: Test Set Results of PatchTST\_VN\_Emb\_CrsAtt 17](#_Toc219797810)

[Figure 29: Actual vs predicted closing prices (PatchTST\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H=1,4,7) 18](#_Toc219797811)

[Figure 30: Actual vs predicted closing prices (PatchTST\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H=10,14,21) 18](#_Toc219797812)

[Figure 31: Multi-horizon stock price prediction on a test sample (PatchTST\_VN\_Emb\_CrsAtt) 19](#_Toc219797813)

[Figure 32: Validation Loss by Window Size and Training Curves of PatchTST\_VN\_Emb\_Concat 19](#_Toc219797814)

[Figure 33: Test Set Results of PatchTST\_VN\_Emb\_Concat 19](#_Toc219797815)

[Figure 34: Actual vs predicted closing prices (PatchTST\_VN\_Emb\_Concat) across multiple forecasting horizons (H=1,4,7) 20](#_Toc219797816)

[Figure 35: Actual vs predicted closing prices (PatchTST\_VN\_Emb\_Concat) across multiple forecasting horizons (H=10,14,21) 20](#_Toc219797817)

[Figure 36: Multi-horizon stock price prediction on a test sample (PatchTST\_VN\_Emb\_Concat) 21](#_Toc219797818)

[Figure 37: Validation Loss by Window Size and Training Curves of PatchTST\_VN\_Doc\_Emb\_CrsAtt 21](#_Toc219797819)

[Figure 38: Test Set Results of PatchTST\_VN\_Doc\_Emb\_CrsAtt 21](#_Toc219797820)

[Figure 39: Actual vs predicted closing prices (PatchTST\_VN\_Doc\_Emb\_CrsAtt) across multiple forecasting horizons (H=1,4,7) 22](#_Toc219797821)

[Figure 40: Actual vs predicted closing prices (PatchTST\_VN\_Doc\_Emb\_CrsAtt) across multiple forecasting horizons (H=10,14,21) 22](#_Toc219797822)

[Figure 41: Multi-horizon stock price prediction on a test sample (PatchTST\_VN\_Doc\_Emb\_CrsAtt) 23](#_Toc219797823)

[Figure 42: Validation Loss by Window Size and Training Curves of PatchTST\_VN\_Doc\_Emb\_Concat 23](#_Toc219797824)

[Figure 43: Test Set Results of PatchTST\_VN\_Doc\_Emb\_Concat 23](#_Toc219797825)

[Figure 44: Actual vs predicted closing prices (PatchTST\_VN\_Doc\_Emb\_Concat) across multiple forecasting horizons (H=1,4,7) 24](#_Toc219797826)

[Figure 45: Actual vs predicted closing prices (PatchTST\_VN\_Doc\_Emb\_Concat) across multiple forecasting horizons (H=10,14,21) 24](#_Toc219797827)

[Figure 46: Multi-horizon stock price prediction on a test sample (PatchTST\_VN\_Doc\_Emb\_Concat) 25](#_Toc219797828)

[Figure 47: Validation Loss by Window Size and Training Curves of iTransformer\_VN\_Emb\_CrsAtt 25](#_Toc219797829)

[Figure 48: Test Set Results of iTransformer\_VN\_Emb\_CrsAtt 25](#_Toc219797830)

[Figure 49: Actual vs predicted closing prices (iTransformer\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H=1,4,7) 26](#_Toc219797831)

[Figure 50: Actual vs predicted closing prices (iTransformer\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H=10,14,21) 26](#_Toc219797832)

[Figure 51: Multi-horizon stock price prediction on a test sample (iTransformer\_VN\_Emb\_CrsAtt) 27](#_Toc219797833)

[Figure 52: Validation Loss by Window Size and Training Curves of iTransformer\_VN\_Emb\_Concat 27](#_Toc219797834)

[Figure 53: Test Set Results of iTransformer\_VN\_Emb\_Concat 27](#_Toc219797835)

[Figure 54: Actual vs predicted closing prices (iTransformer\_VN\_Emb\_Concat) across multiple forecasting horizons (H=1,4,7) 28](#_Toc219797836)

[Figure 55: Actual vs predicted closing prices (iTransformer\_VN\_Emb\_Concat) across multiple forecasting horizons (H=10,14,21) 28](#_Toc219797837)

[Figure 56: Multi-horizon stock price prediction on a test sample (iTransformer\_VN\_Emb\_Concat) 29](#_Toc219797838)

[Figure 57: Validation Loss by Window Size and Training Curves of iTransformer\_VN\_Doc\_Emb\_CrsAtt 29](#_Toc219797839)

[Figure 58: Test Set Results of iTransformer\_VN\_Doc\_Emb\_CrsAtt 29](#_Toc219797840)

[Figure 59: Actual vs predicted closing prices (iTransformer\_VN\_Doc\_Emb\_CrsAtt) across multiple forecasting horizons (H=1,4,7) 30](#_Toc219797841)

[Figure 60: Actual vs predicted closing prices (iTransformer\_VN\_Doc\_Emb\_CrsAtt) across multiple forecasting horizons (H=10,14,21) 30](#_Toc219797842)

[Figure 61: Multi-horizon stock price prediction on a test sample (iTransformer\_VN\_Doc\_Emb\_CrsAtt) 31](#_Toc219797843)

[Figure 62: Validation Loss by Window Size and Training Curves of iTransformer\_VN\_Doc\_Emb\_Concat 31](#_Toc219797844)

[Figure 63: Test Set Results of iTransformer\_VN\_Doc\_Emb\_Concat 31](#_Toc219797845)

[Figure 64: Actual vs predicted closing prices (iTransformer\_VN\_Doc\_Emb\_Concat) across multiple forecasting horizons (H=1,4,7) 32](#_Toc219797846)

[Figure 65: Actual vs predicted closing prices (iTransformer\_VN\_Doc\_Emb\_Concat) across multiple forecasting horizons (H=10,14,21) 32](#_Toc219797847)

[Figure 66: Multi-horizon stock price prediction on a test sample (iTransformer\_VN\_Doc\_Emb\_Concat) 33](#_Toc219797848)

# LSTM (baseline for comparison)

## Result of Full Features

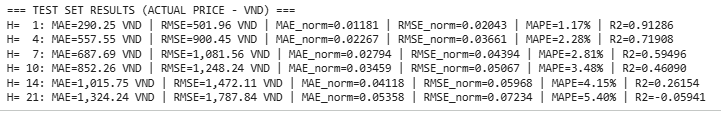


Figure 1: Test Set Results of LSTM Full Features

## Result of Filtered Features

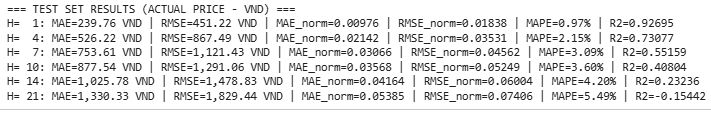


Figure 2: Test Set Results of LSTM Filtered Features

# PatchTST (baseline for comparison)

## Result of Full Features

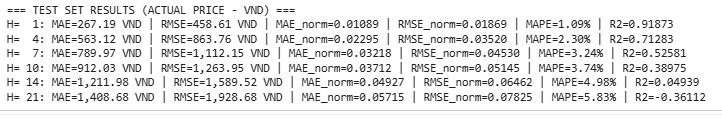


Figure 3: Test Set Results of PatchTST Full Features

## Result of Filtered Features

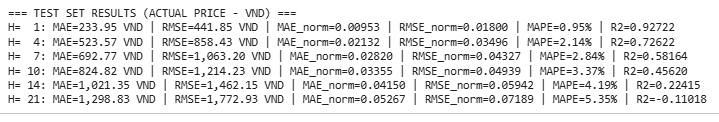


Figure 4: Test Set Results of PatchTST Filtered Features

# iTransformer (baseline for comparison)

## Result of Full Features

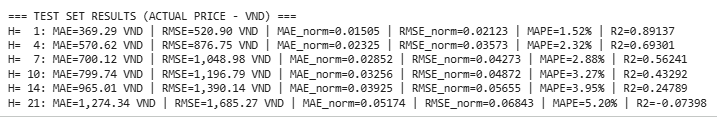


Figure 5: Test Set Results of iTransFormer Full Features

## Result of Filtered Features

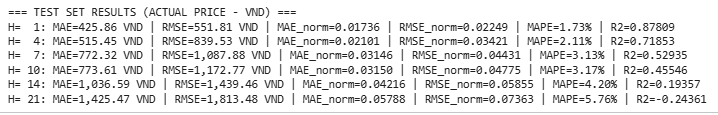


Figure 6: Test Set Results of iTransFormer Filtered Features

# LSTM + Vietnamese Embedding

## Results

### Cross-Attention Fusion

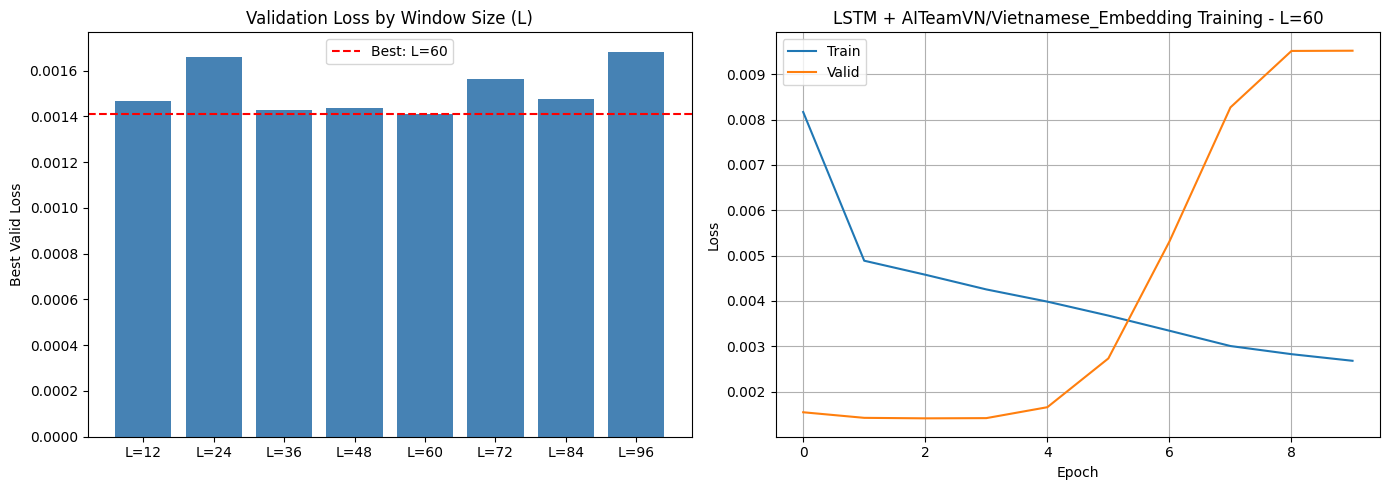


Figure 7: Validation Loss by Window Size and Training Curves of LSTM\_VN\_Emb\_CrsAtt

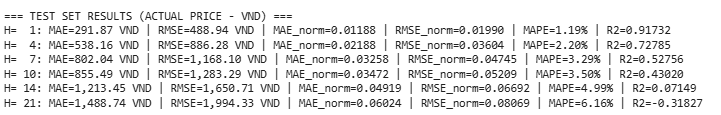


Figure 8: Test Set Results of LSTM\_VN\_Emb\_CrsAtt

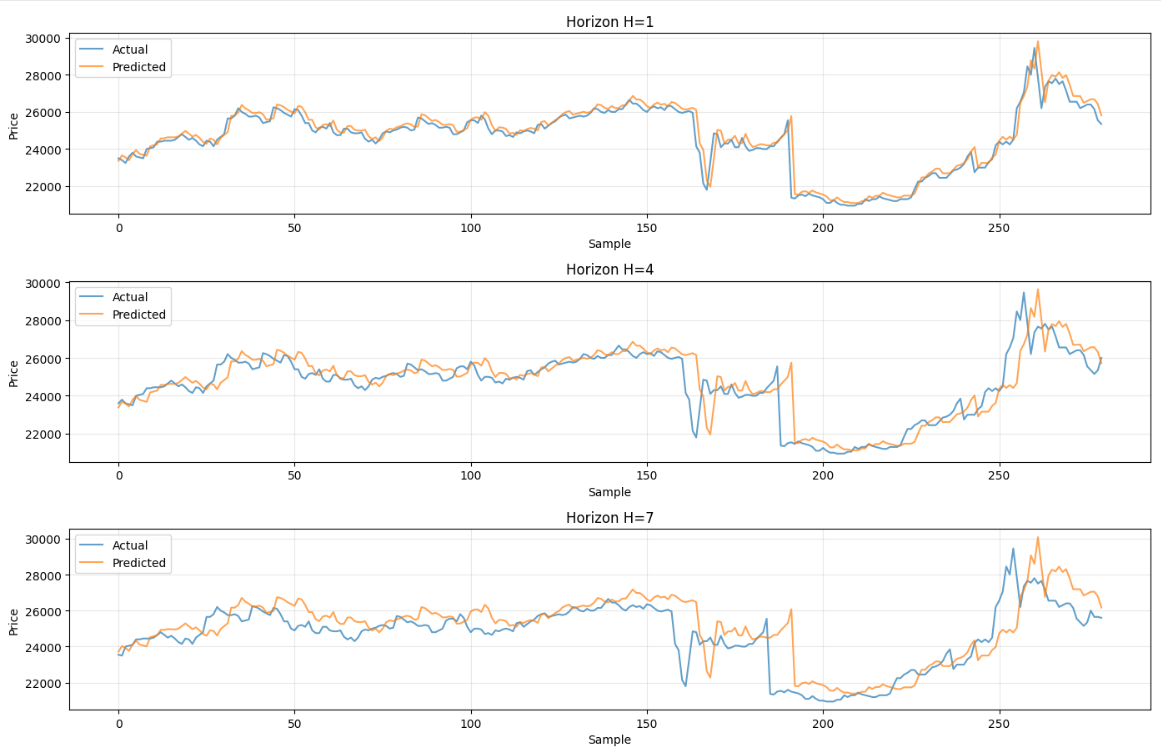


Figure 9: Actual vs predicted closing prices (LSTM\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H = 1, 4, 7)

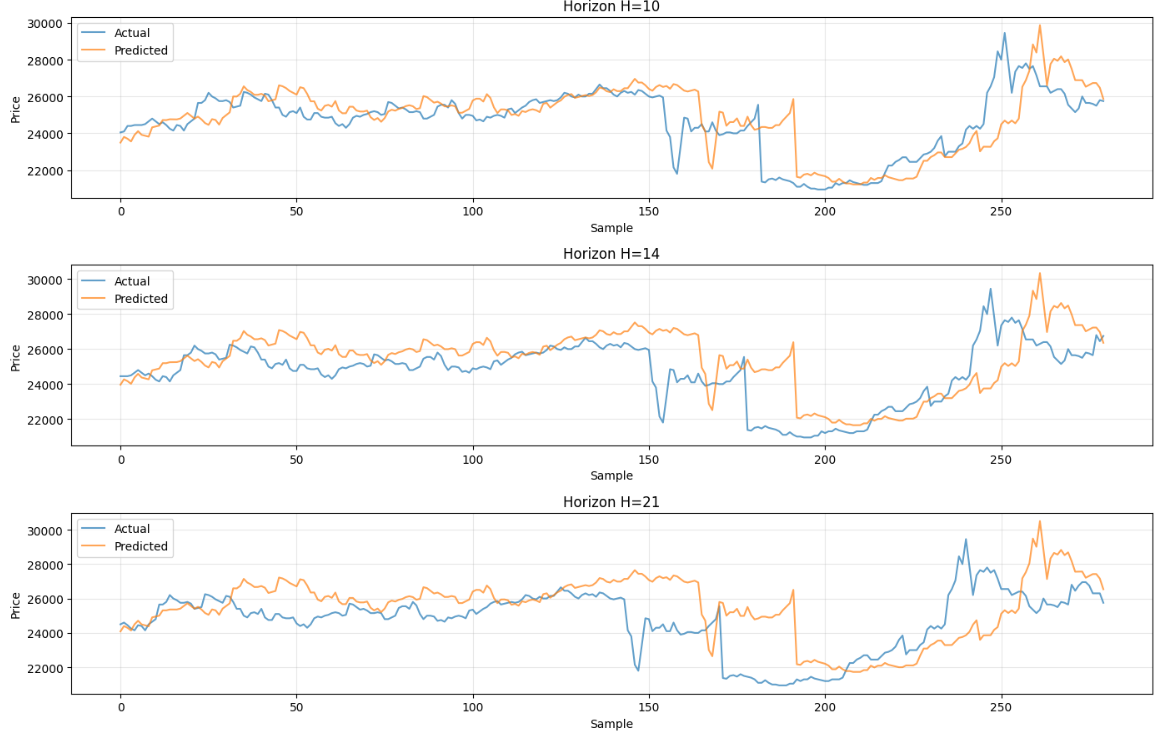


Figure 10: Actual vs predicted closing prices on (LSTM\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H = 10, 14, 21)

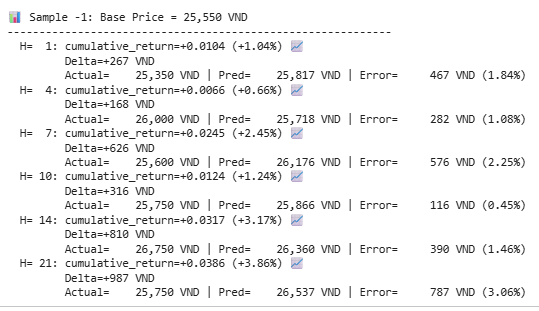


Figure 11: Multi-horizon stock price prediction on a test sample (LSTM\_VN\_Emb\_CrsAtt)

### Concatenate Fusion

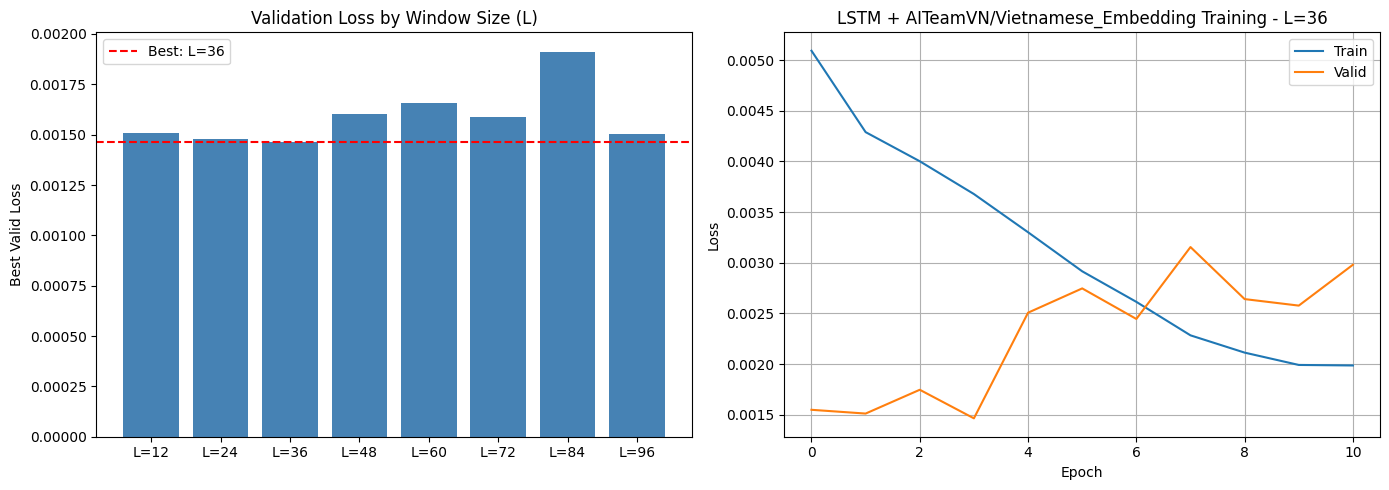


Figure 12: Validation Loss by Window Size and Training Curves of LSTM\_VN\_Emb\_Concat

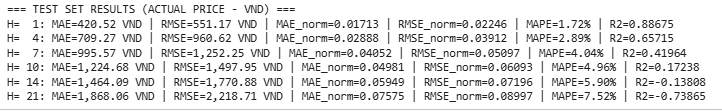


Figure 13: Test Set Results of LSTM\_VN\_Emb\_Concat

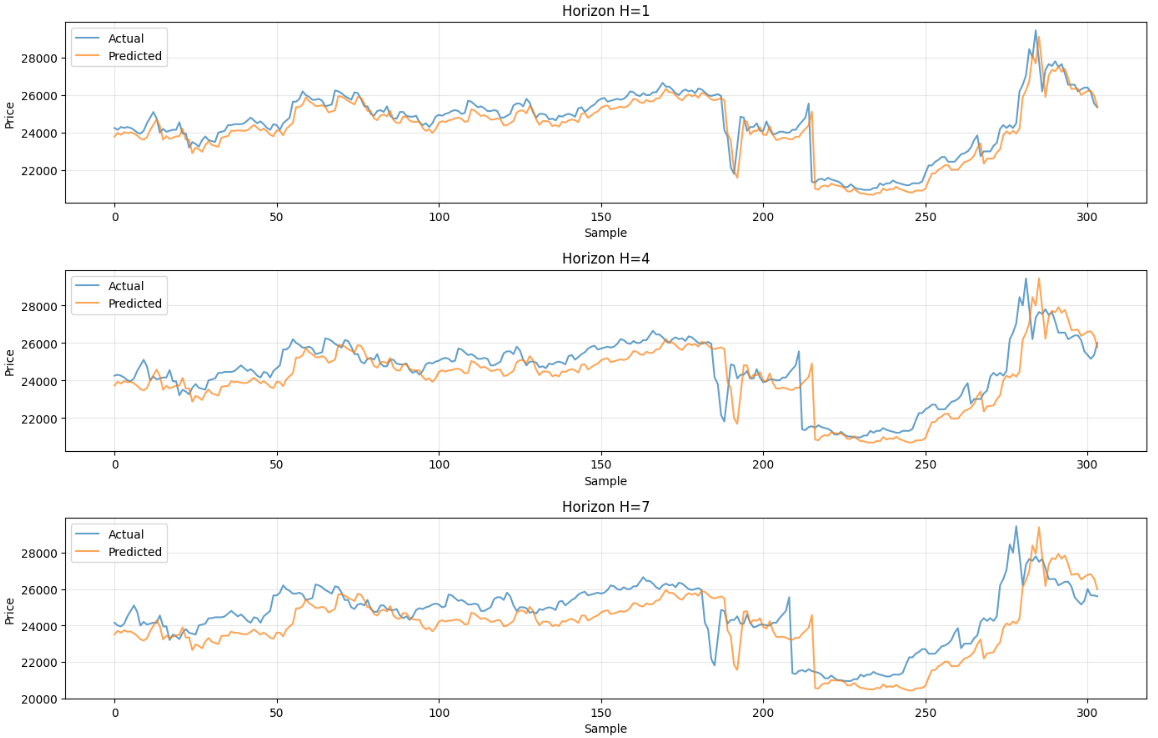


Figure 14: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Concat) across multiple forecasting horizons (H = 1, 4, 7)



Figure 15: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Concat) across multiple forecasting horizons (H = 10, 14, 21)

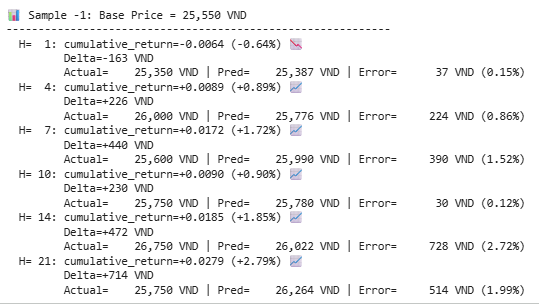


Figure 16: Multi-horizon stock price prediction on a test sample (LSTM\_VN\_Emb\_ConCat)

# LSTM + Vietnamese Document Embedding

## Results

### Cross-Attention

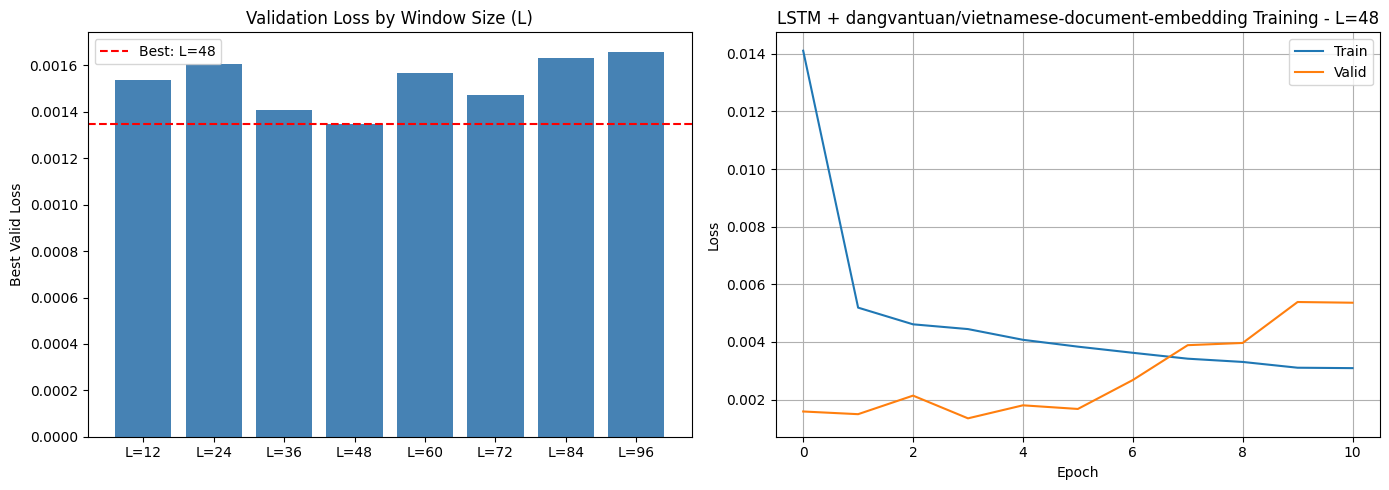


Figure 17: Validation Loss by Window Size and Training Curves of LSTM\_VN\_Doc\_Emb\_CrsAtt

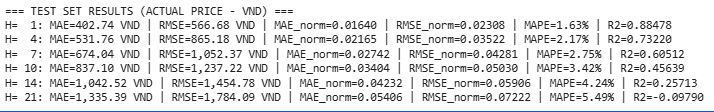


Figure 18: Test Set Results of LSTM\_VN\_Doc\_Emb\_CrsAtt

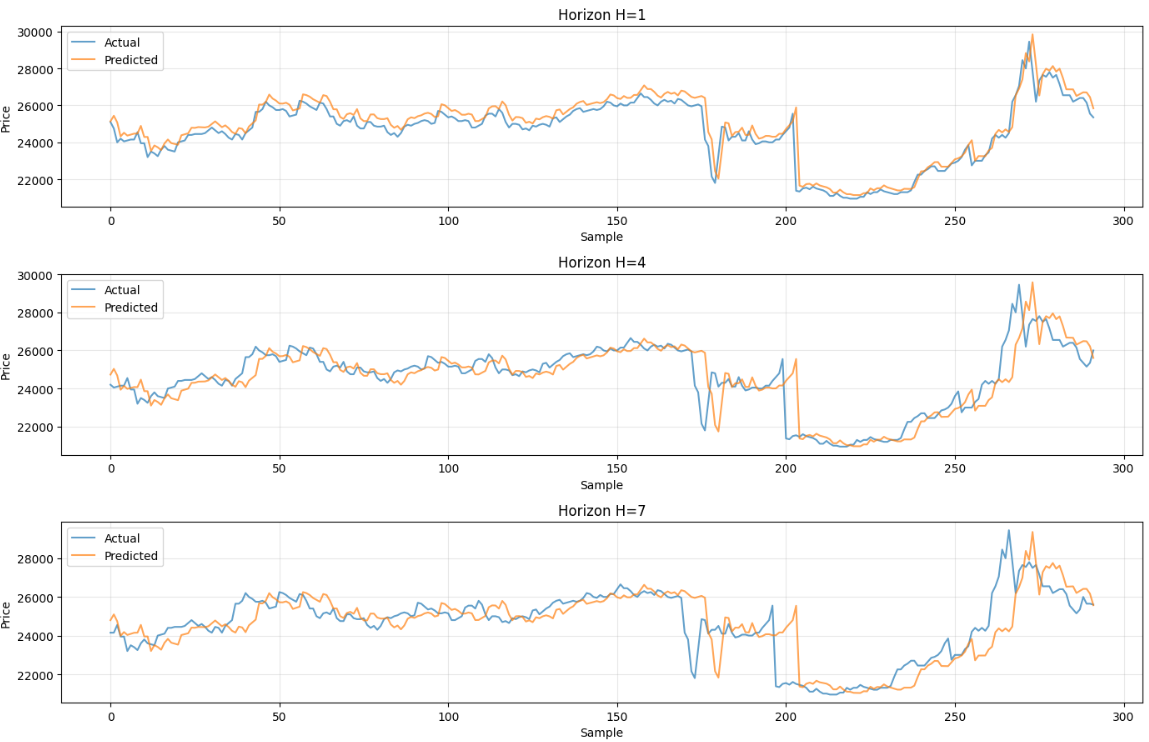


Figure 19: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Doc\_CrsAtt) across multiple forecasting horizons (H = 1, 4, 7)

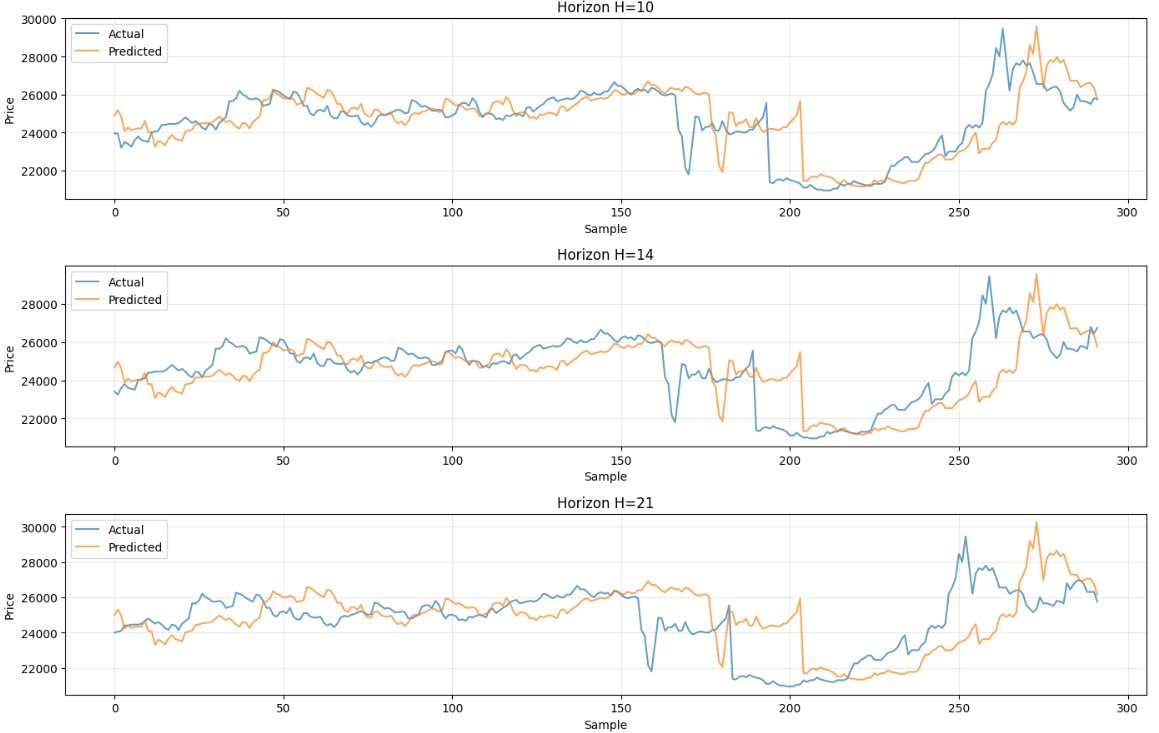


Figure 20: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Doc\_CrsAtt) across multiple forecasting horizons (H=10,14,21)

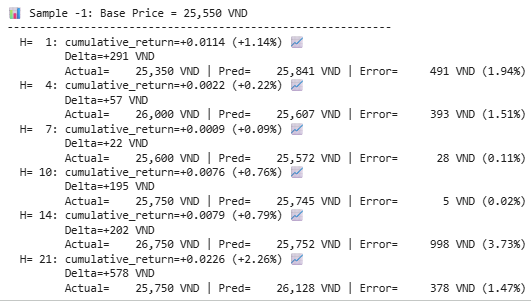


Figure 21: Multi-horizon stock price prediction on a test sample (LSTM\_VN\_Doc\_Emb\_CrsAtt)

### Concatenate Fusion

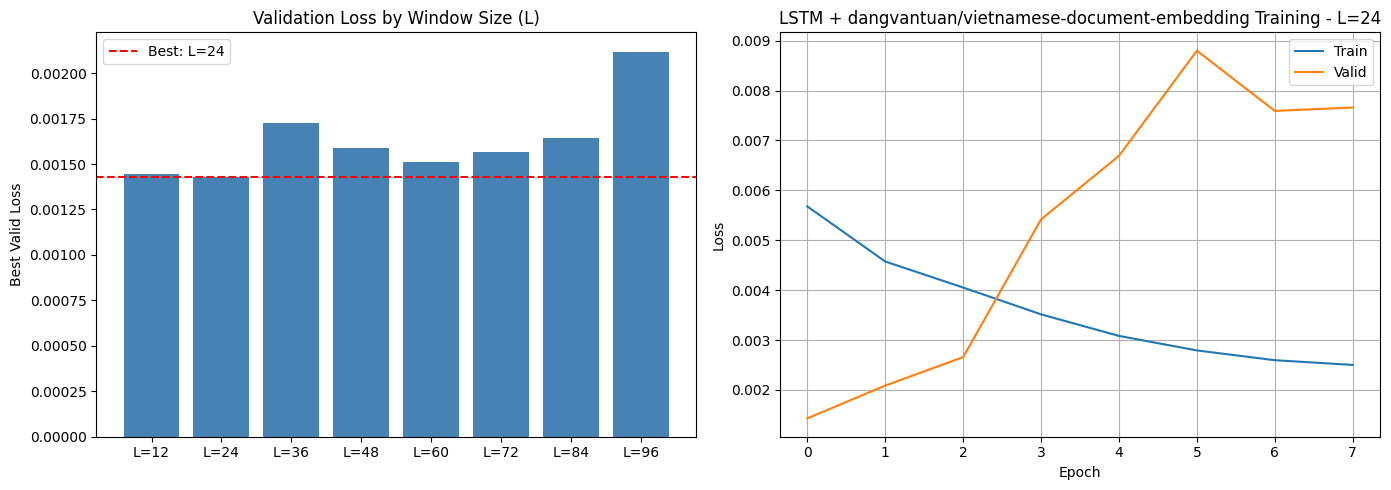


Figure 22: Validation Loss by Window Size and Training Curves of LSTM\_VN\_Doc\_Emb\_Concat

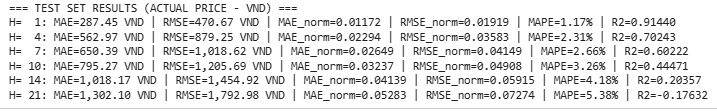


Figure 23: Test Set Results of LSTM\_VN\_Doc\_Emb\_Concat

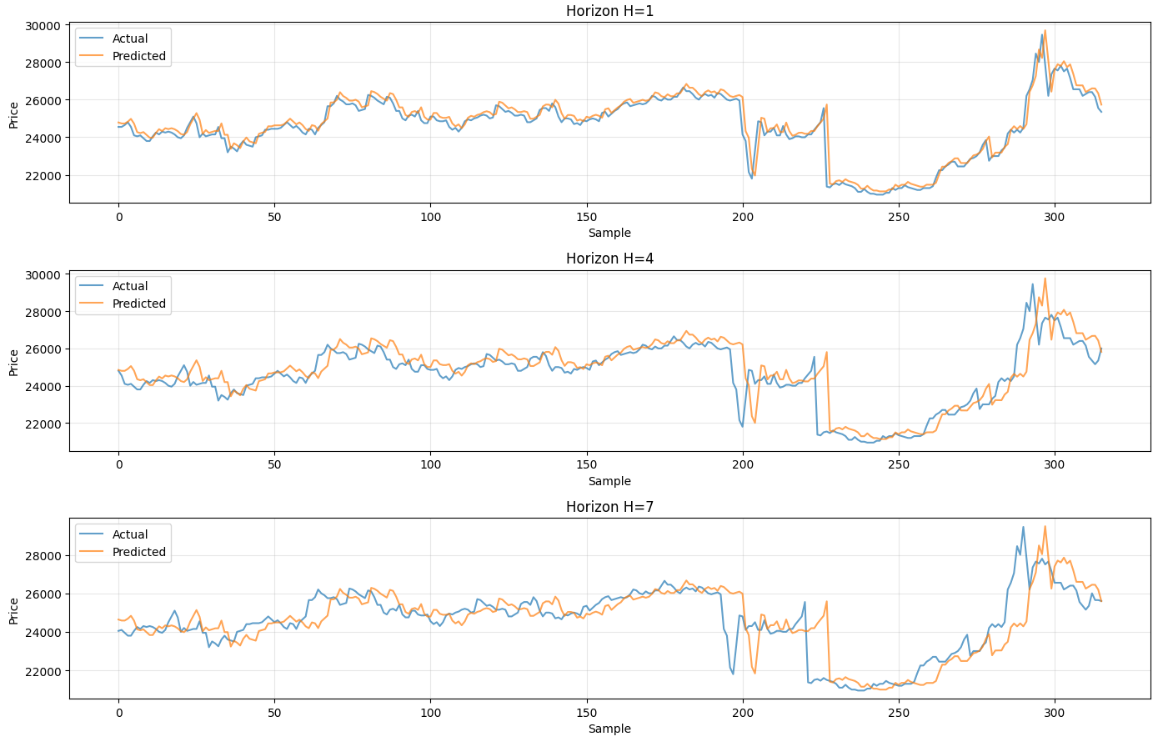


Figure 24: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Doc\_Concat) across multiple forecasting horizons (H = 1, 4, 7)

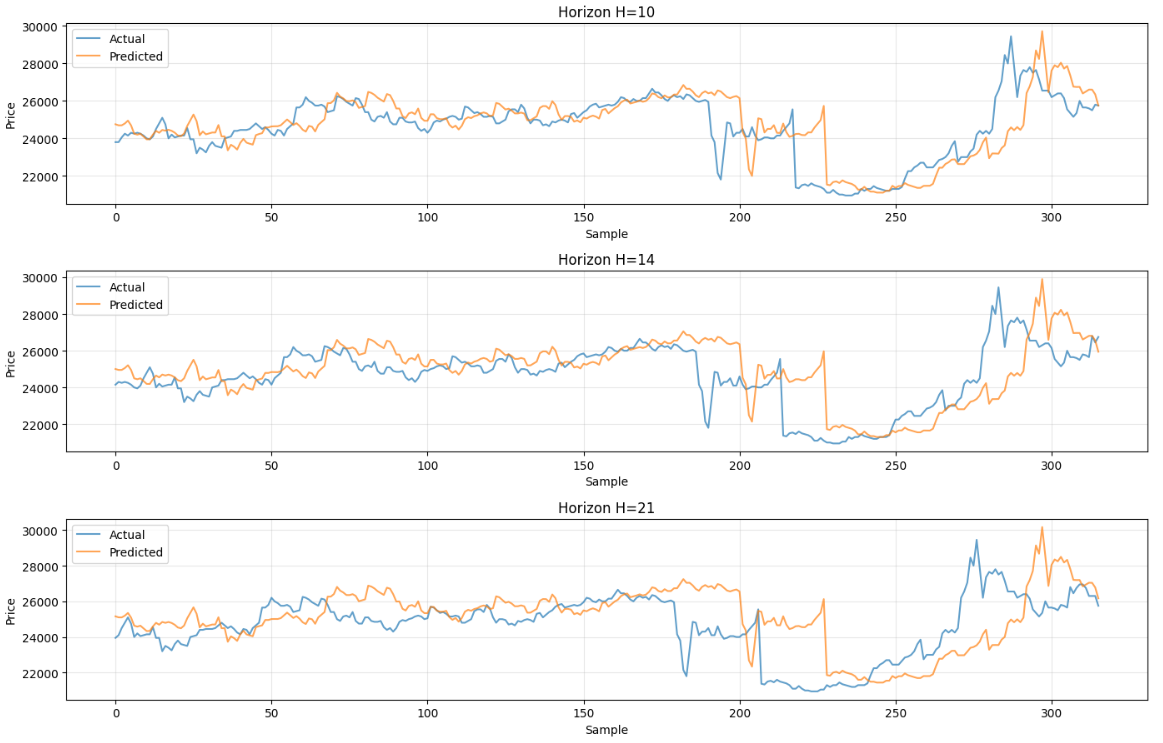


Figure 25: Actual vs predicted closing prices (LSTM\_VN\_Emb\_Doc\_Concat) across multiple forecasting horizons (H=10,14,21)

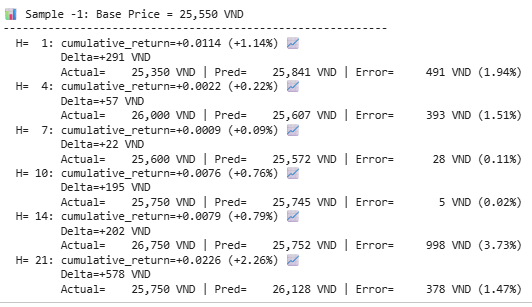


Figure 26: Multi-horizon stock price prediction on a test sample (LSTM\_VN\_Doc\_Emb\_Concat)

# PatchTST + Vietnamese Embedding

## Results

### Cross-Attention



Figure 27: Validation Loss by Window Size and Training Curves of PatchTST\_VN\_Emb\_CrsAtt



Figure 28: Test Set Results of PatchTST\_VN\_Emb\_CrsAtt

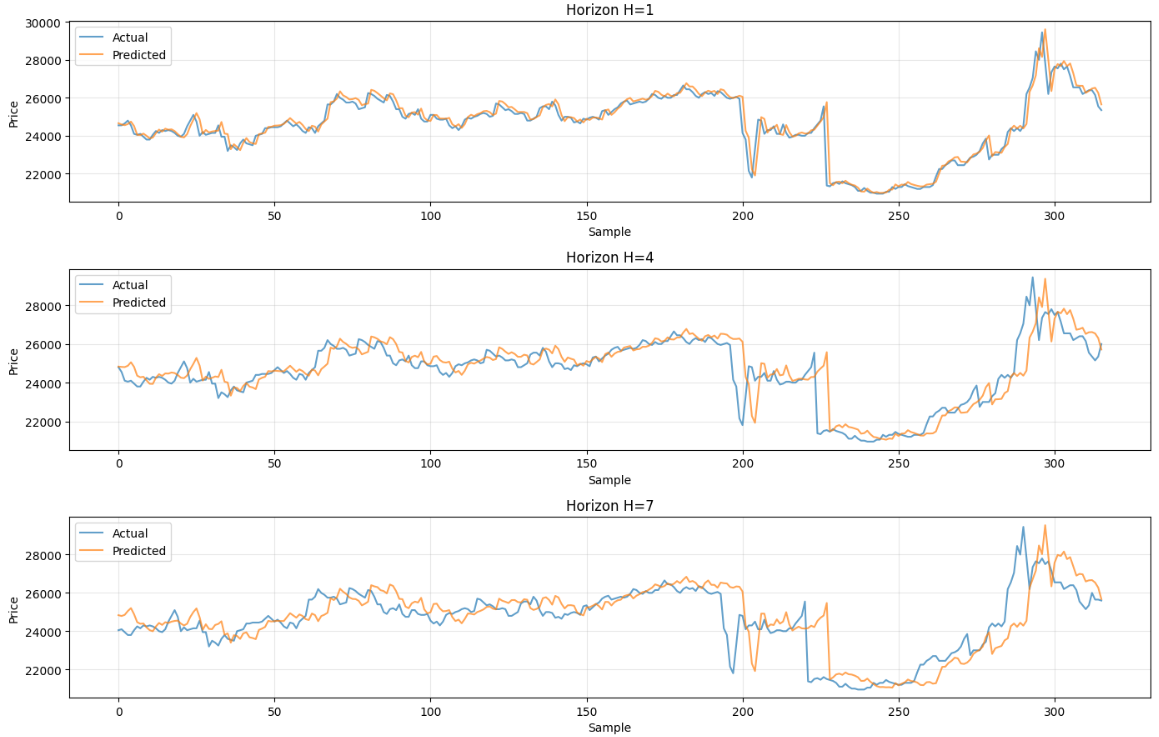


Figure 29: Actual vs predicted closing prices (PatchTST\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H=1,4,7)

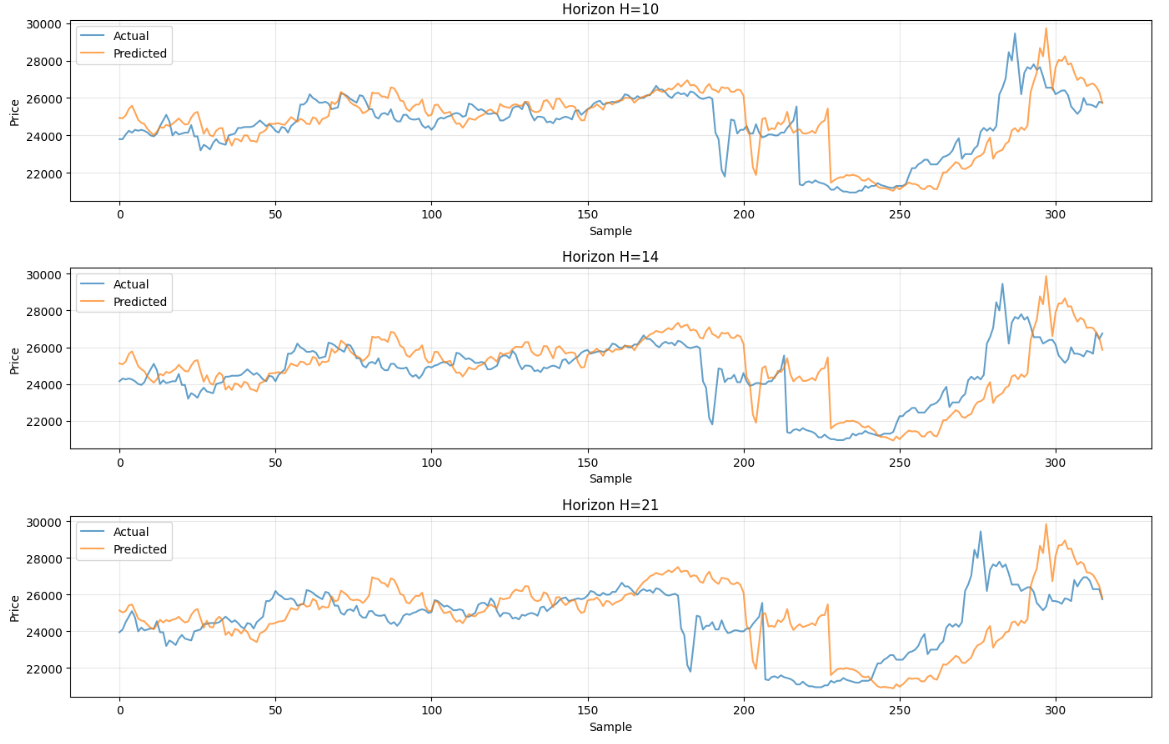


Figure 30: Actual vs predicted closing prices (PatchTST\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H=10,14,21)

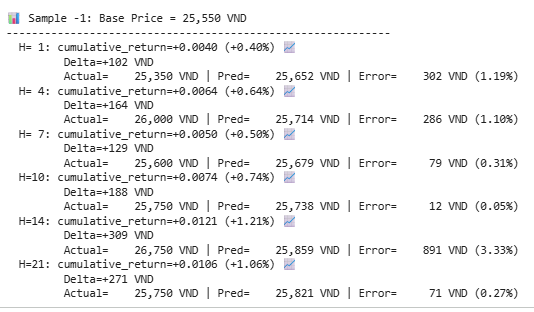


Figure 31: Multi-horizon stock price prediction on a test sample (PatchTST\_VN\_Emb\_CrsAtt)

### Concatenate Fusion

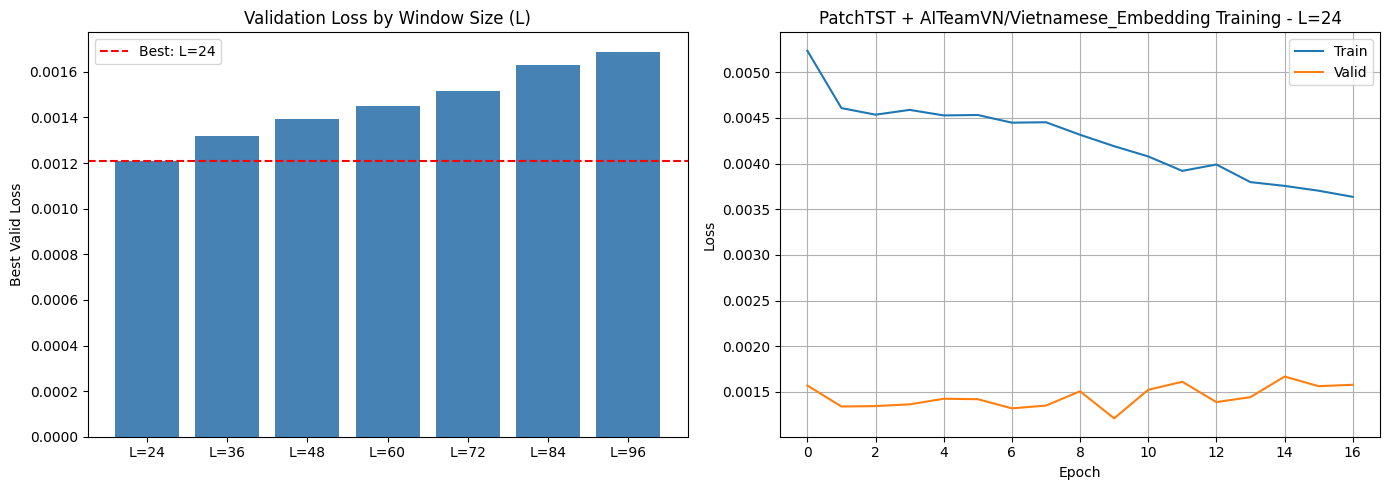


Figure 32: Validation Loss by Window Size and Training Curves of PatchTST\_VN\_Emb\_Concat

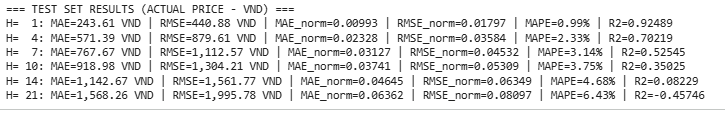


Figure 33: Test Set Results of PatchTST\_VN\_Emb\_Concat

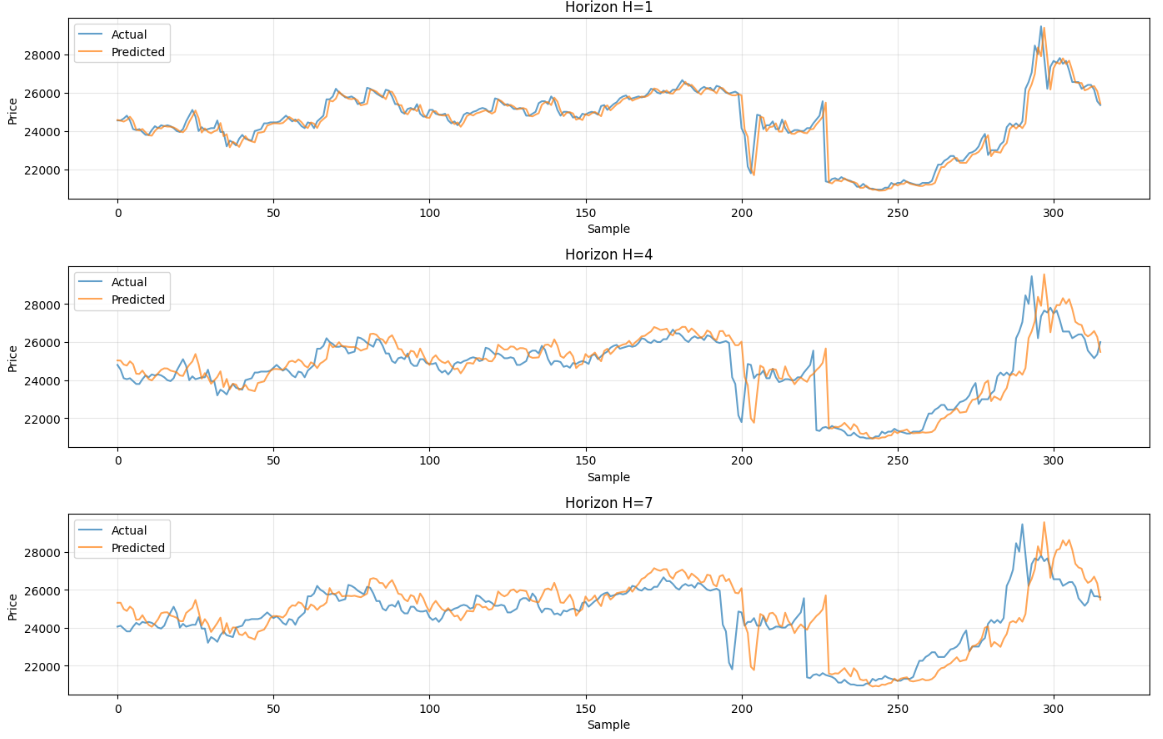


Figure 34: Actual vs predicted closing prices (PatchTST\_VN\_Emb\_Concat) across multiple forecasting horizons (H=1,4,7)

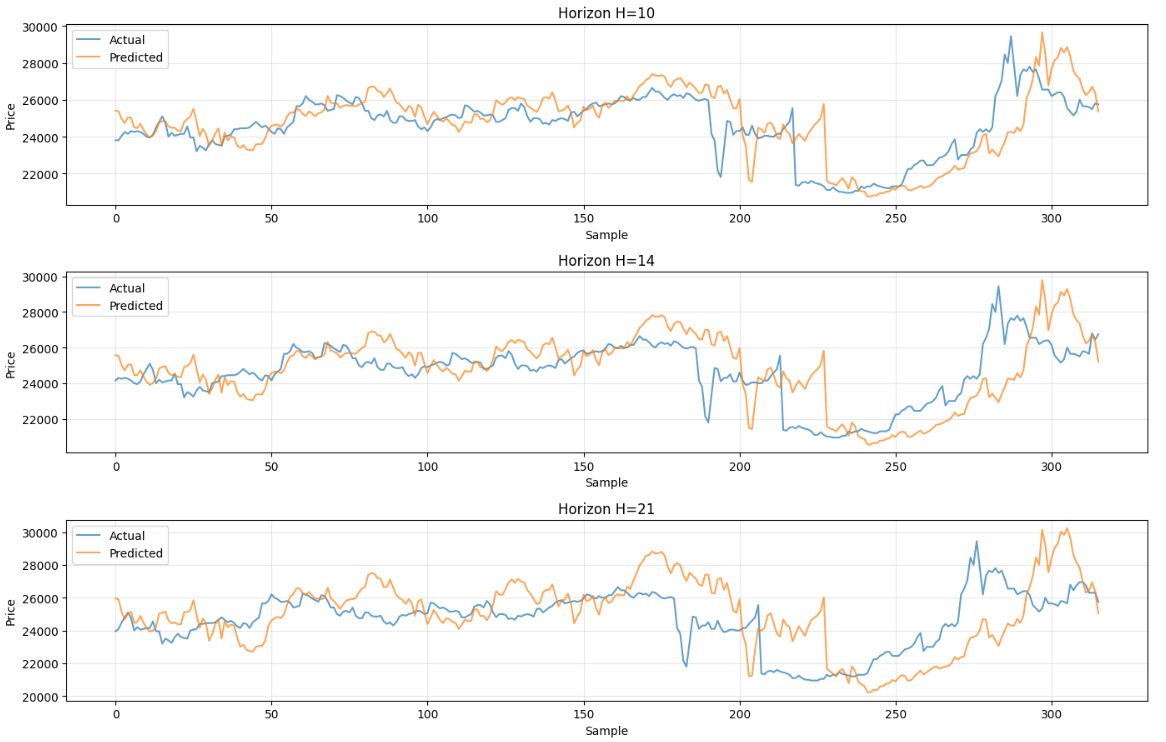


Figure 35: Actual vs predicted closing prices (PatchTST\_VN\_Emb\_Concat) across multiple forecasting horizons (H=10,14,21)



Figure 36: Multi-horizon stock price prediction on a test sample (PatchTST\_VN\_Emb\_Concat)

# PatchTST + Vietnamese Document Embedding

## Results

### Cross-Attention

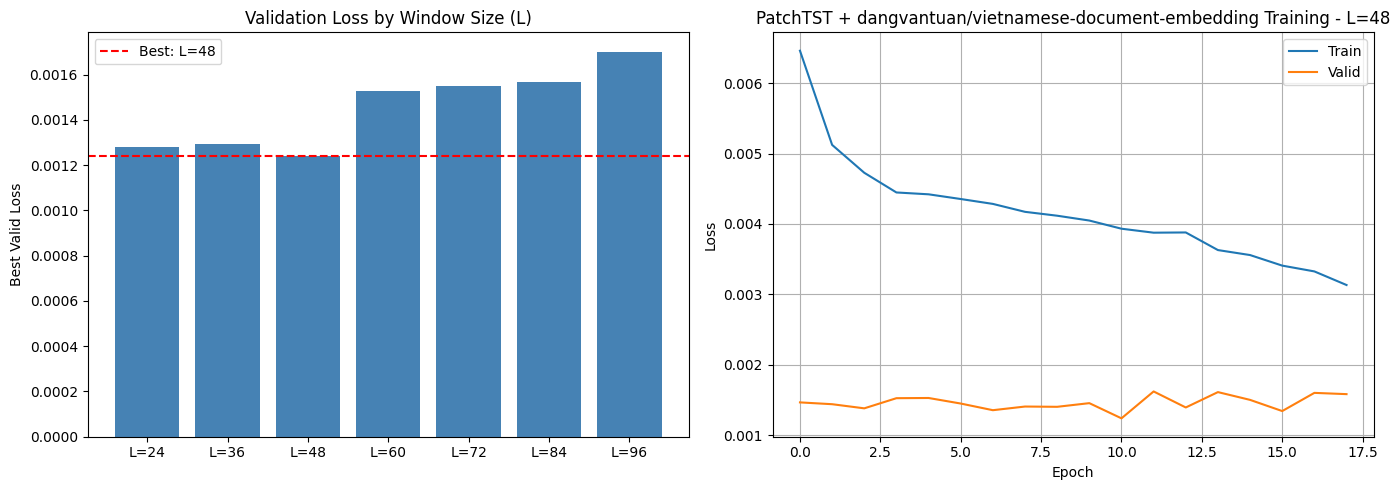


Figure 37: Validation Loss by Window Size and Training Curves of PatchTST\_VN\_Doc\_Emb\_CrsAtt

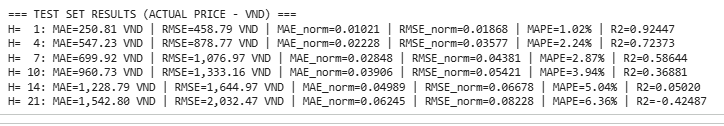


Figure 38: Test Set Results of PatchTST\_VN\_Doc\_Emb\_CrsAtt

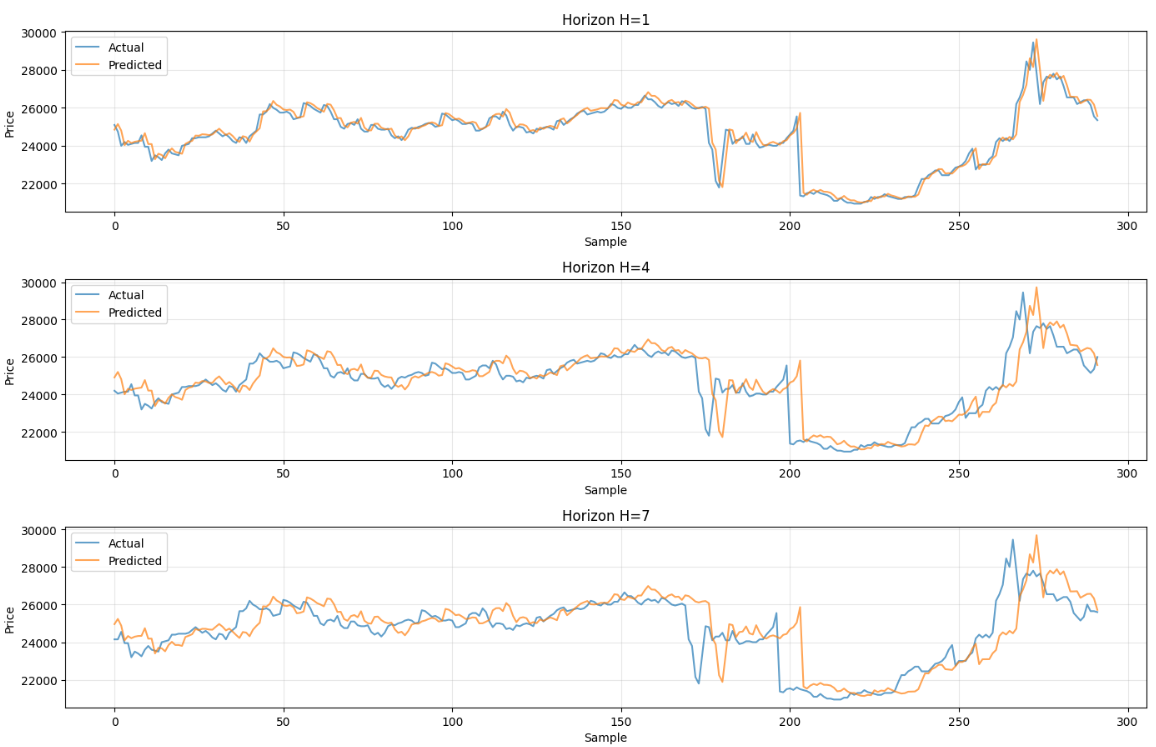


Figure 39: Actual vs predicted closing prices (PatchTST\_VN\_Doc\_Emb\_CrsAtt) across multiple forecasting horizons (H=1,4,7)

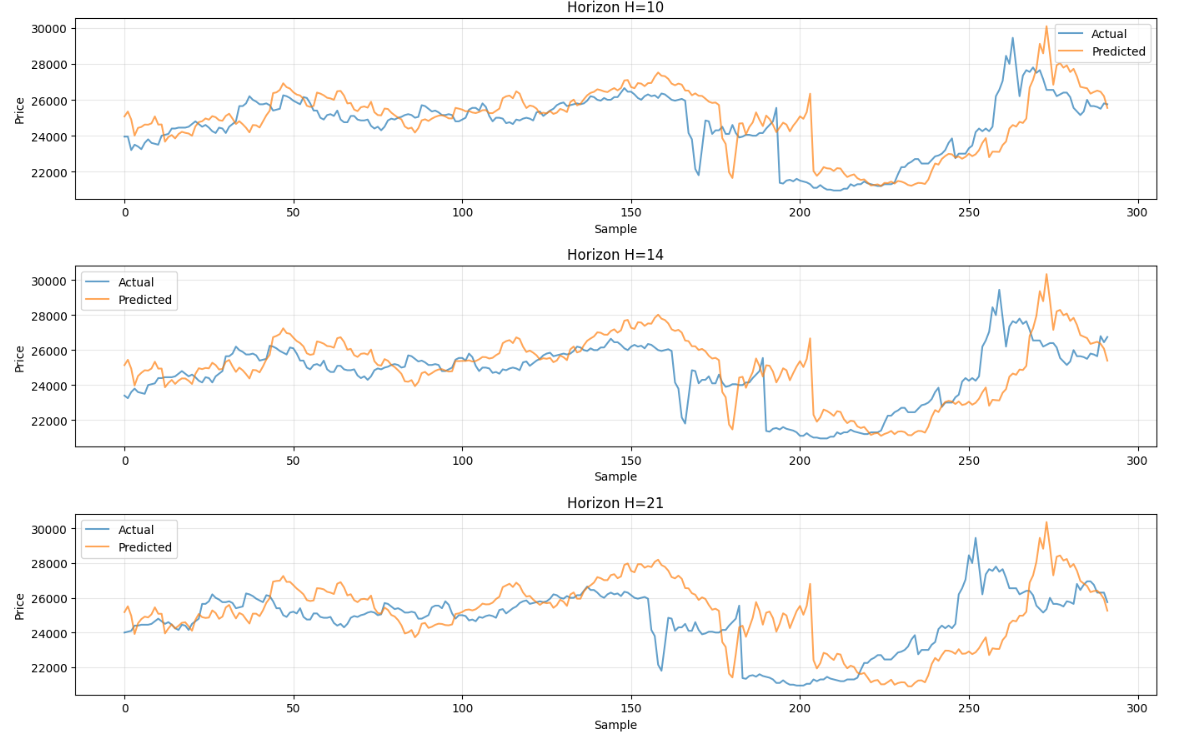


Figure 40: Actual vs predicted closing prices (PatchTST\_VN\_Doc\_Emb\_CrsAtt) across multiple forecasting horizons (H=10,14,21)

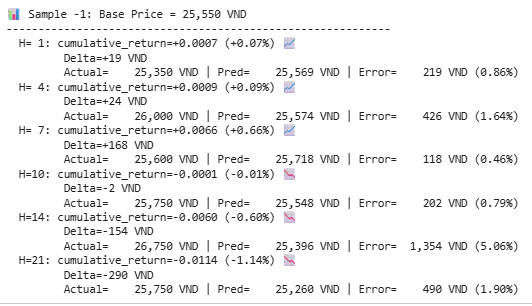


Figure 41: Multi-horizon stock price prediction on a test sample (PatchTST\_VN\_Doc\_Emb\_CrsAtt)

### Concatenate Fusion

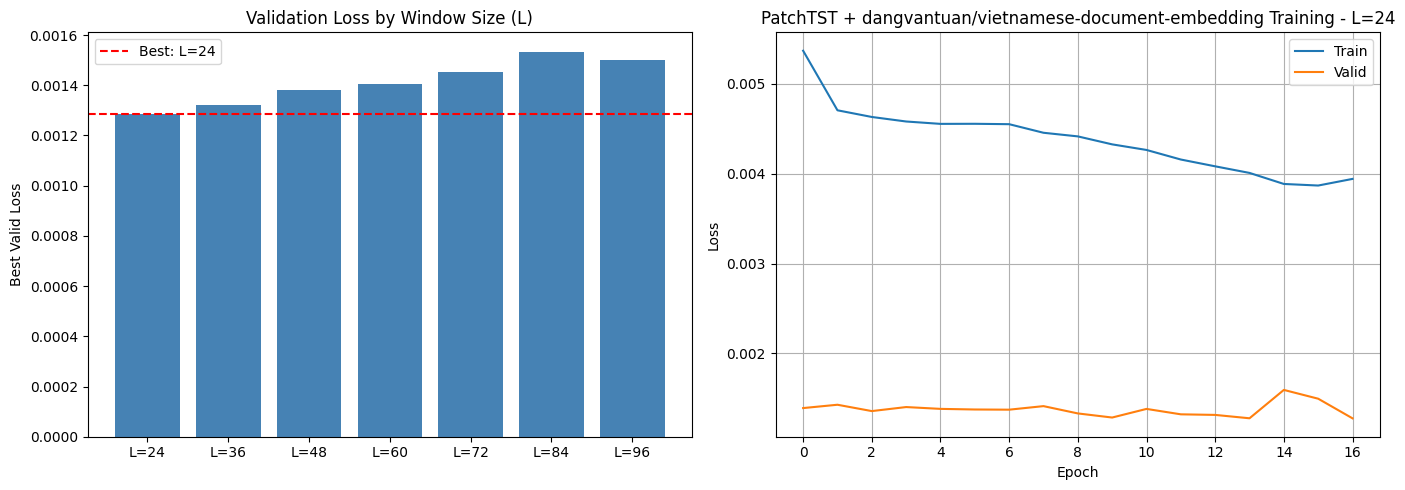


Figure 42: Validation Loss by Window Size and Training Curves of PatchTST\_VN\_Doc\_Emb\_Concat

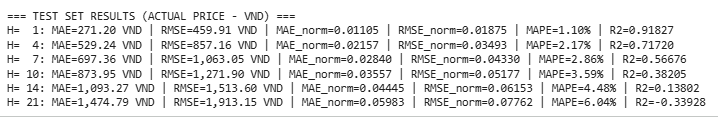


Figure 43: Test Set Results of PatchTST\_VN\_Doc\_Emb\_Concat

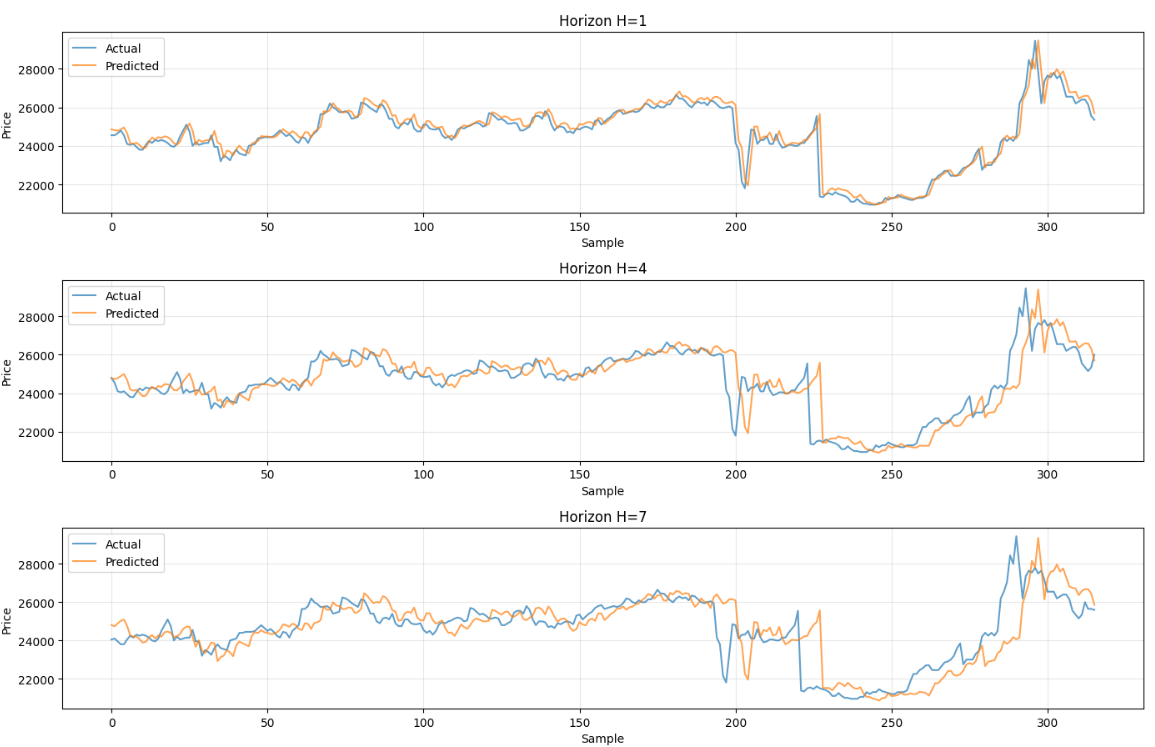


Figure 44: Actual vs predicted closing prices (PatchTST\_VN\_Doc\_Emb\_Concat) across multiple forecasting horizons (H=1,4,7)



Figure 45: Actual vs predicted closing prices (PatchTST\_VN\_Doc\_Emb\_Concat) across multiple forecasting horizons (H=10,14,21)

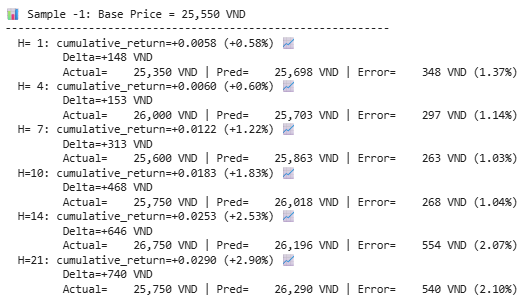


Figure 46: Multi-horizon stock price prediction on a test sample (PatchTST\_VN\_Doc\_Emb\_Concat)

# iTransformer + Vietnamese Embedding

## Results

### Cross-Attention

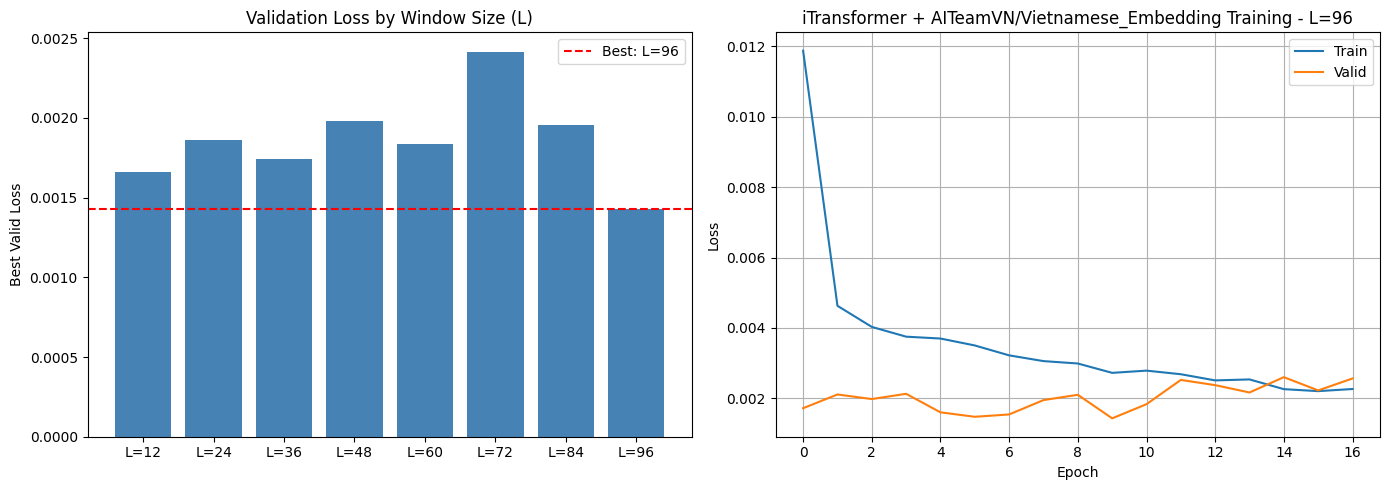


Figure 47: Validation Loss by Window Size and Training Curves of iTransformer\_VN\_Emb\_CrsAtt

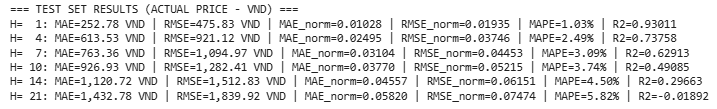


Figure 48: Test Set Results of iTransformer\_VN\_Emb\_CrsAtt

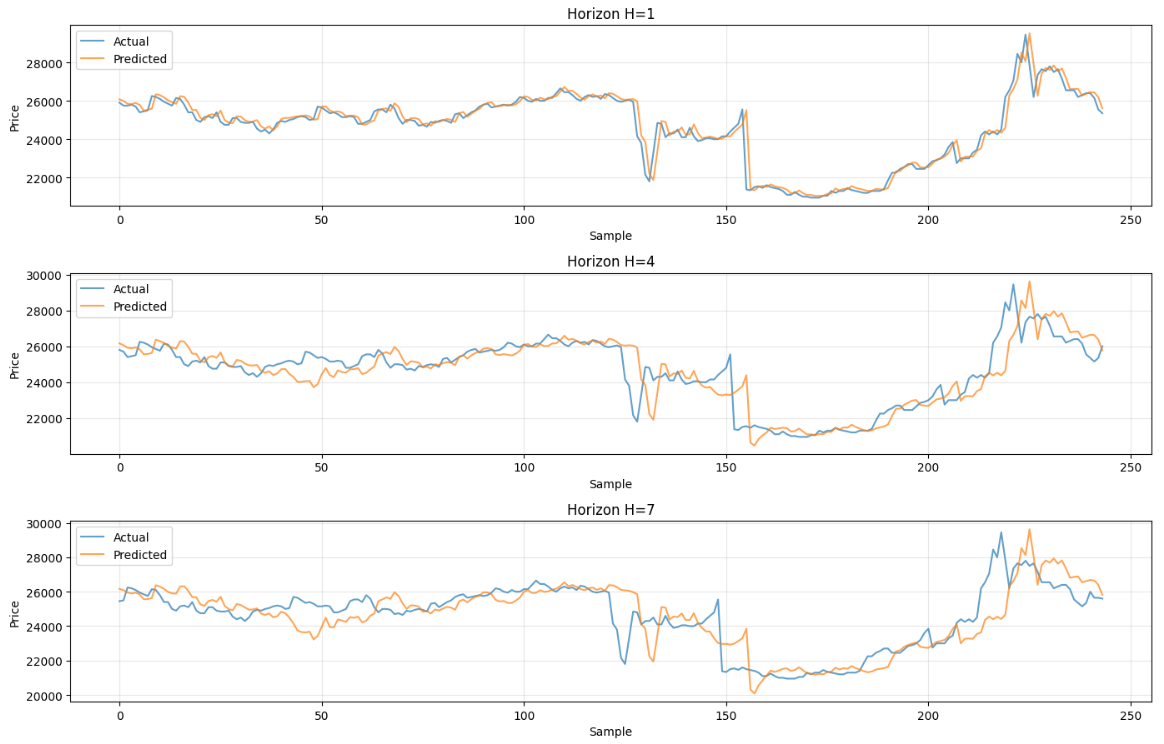


Figure 49: Actual vs predicted closing prices (iTransformer\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H=1,4,7)



Figure 50: Actual vs predicted closing prices (iTransformer\_VN\_Emb\_CrsAtt) across multiple forecasting horizons (H=10,14,21)

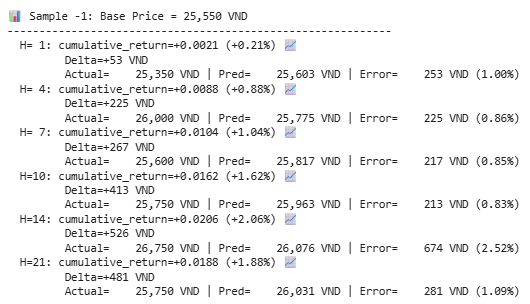


Figure 51: Multi-horizon stock price prediction on a test sample (iTransformer\_VN\_Emb\_CrsAtt)

### Concatenate Fusion

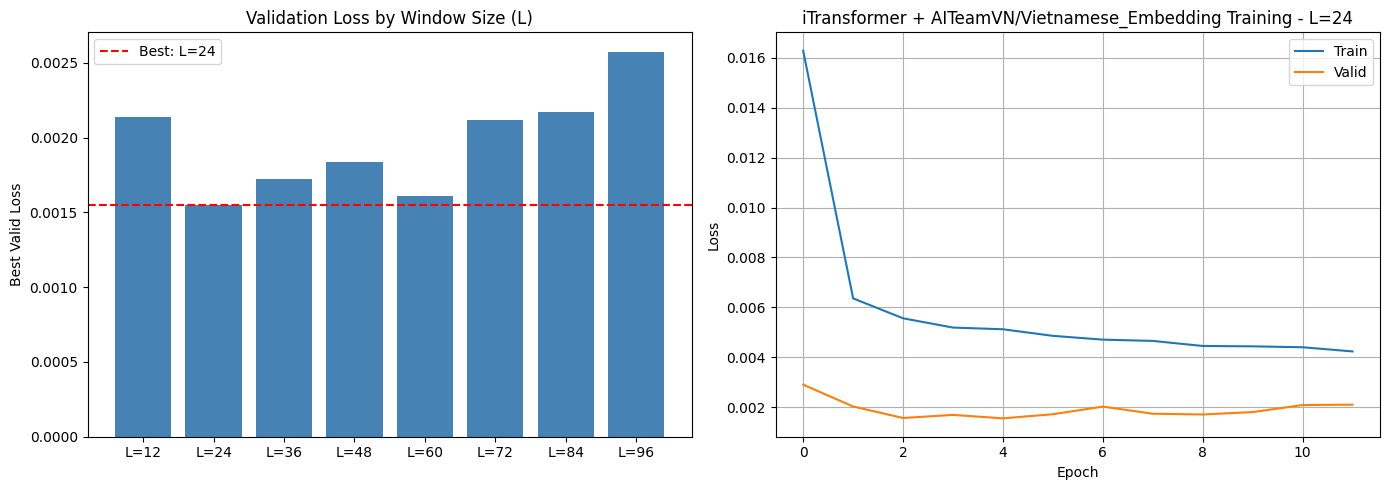


Figure 52: Validation Loss by Window Size and Training Curves of iTransformer\_VN\_Emb\_Concat

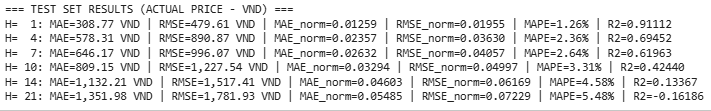


Figure 53: Test Set Results of iTransformer\_VN\_Emb\_Concat

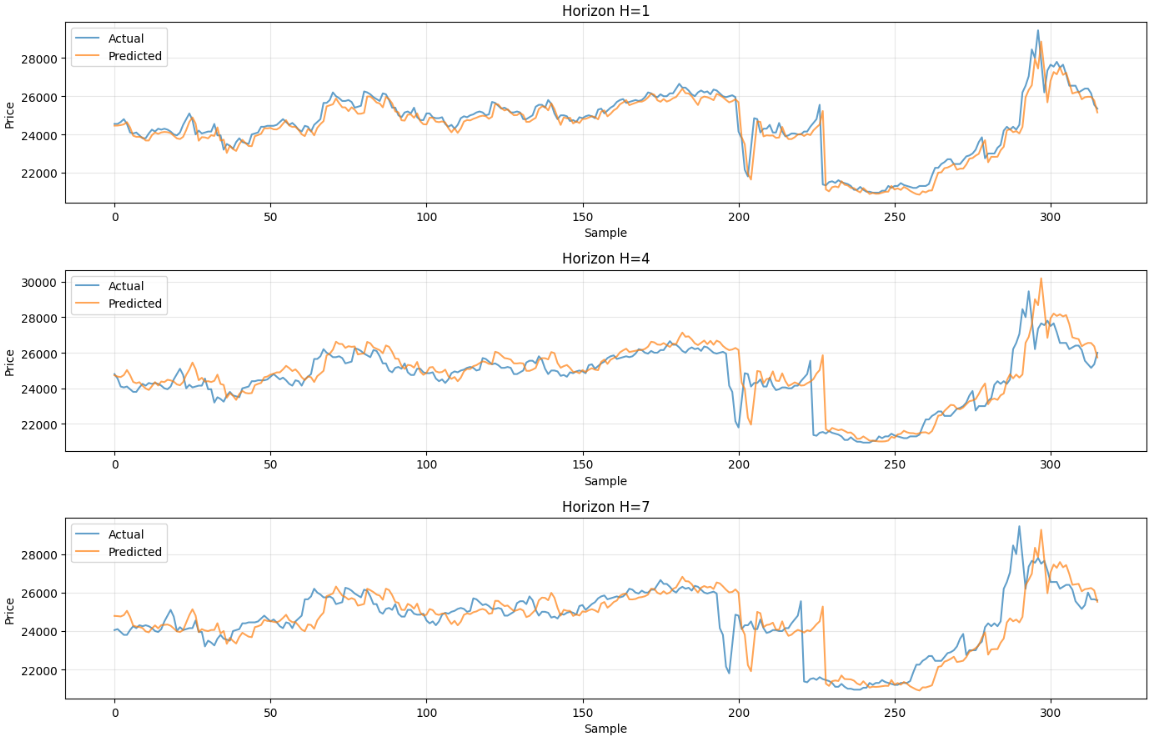


Figure 54: Actual vs predicted closing prices (iTransformer\_VN\_Emb\_Concat) across multiple forecasting horizons (H=1,4,7)

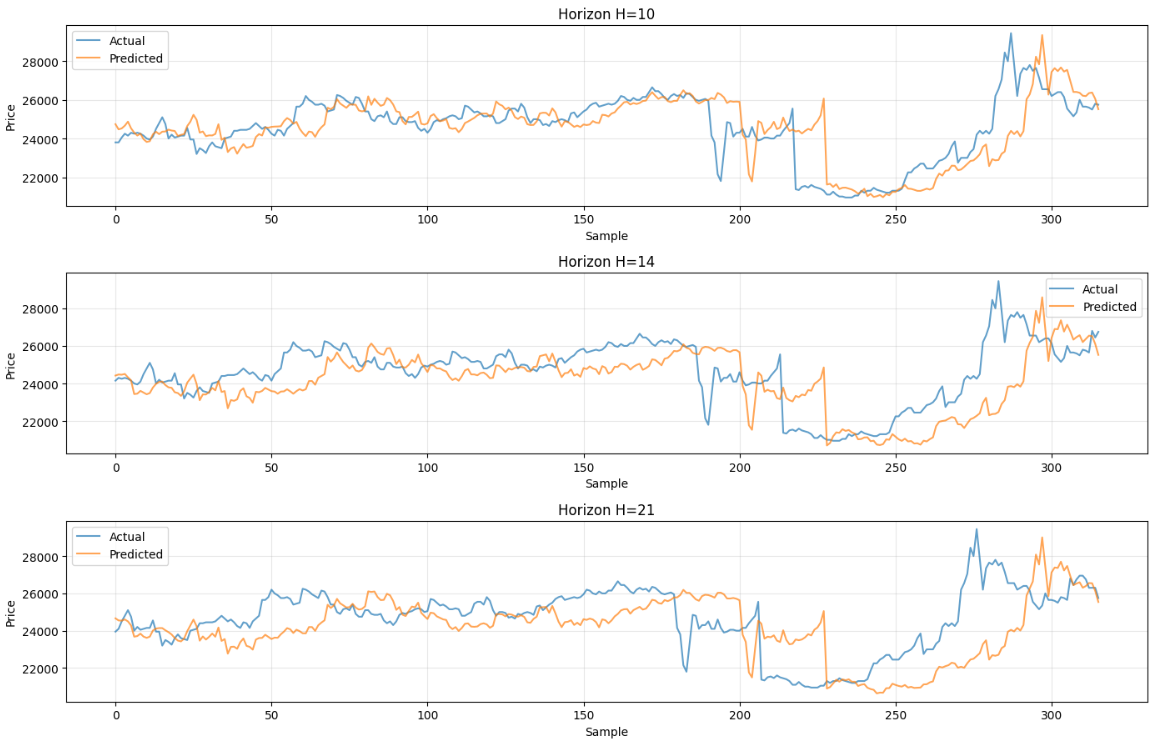


Figure 55: Actual vs predicted closing prices (iTransformer\_VN\_Emb\_Concat) across multiple forecasting horizons (H=10,14,21)

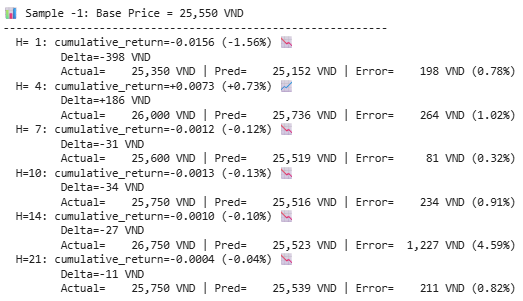


Figure 56: Multi-horizon stock price prediction on a test sample (iTransformer\_VN\_Emb\_Concat)

# iTransformer + Vietnamese Document Embedding

## Results

### Cross-Attention

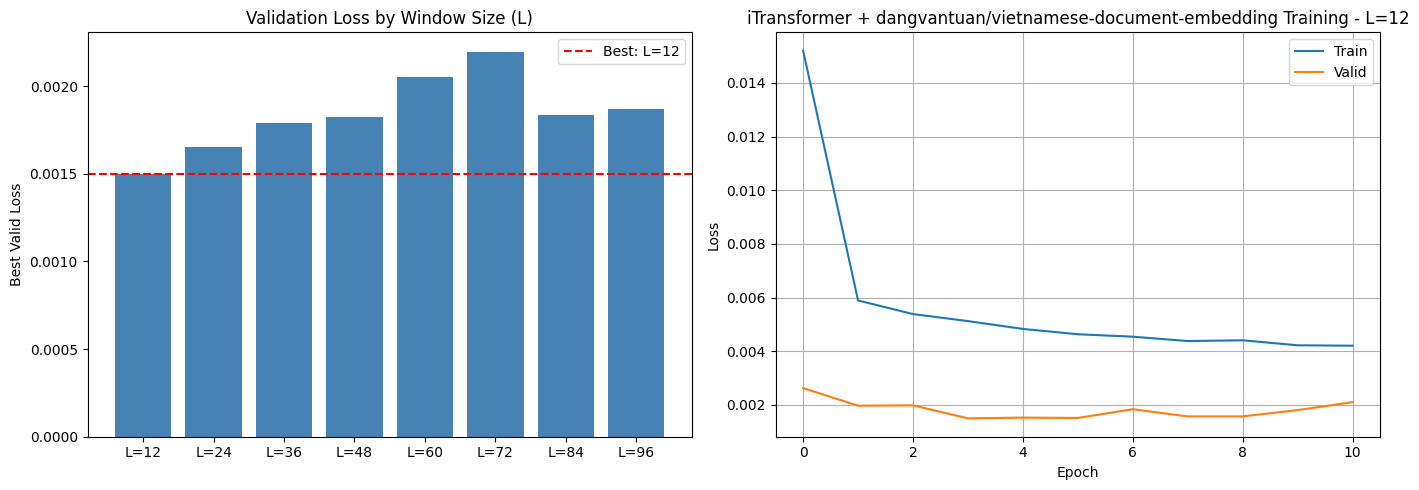


Figure 57: Validation Loss by Window Size and Training Curves of iTransformer\_VN\_Doc\_Emb\_CrsAtt

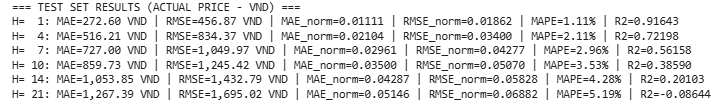


Figure 58: Test Set Results of iTransformer\_VN\_Doc\_Emb\_CrsAtt

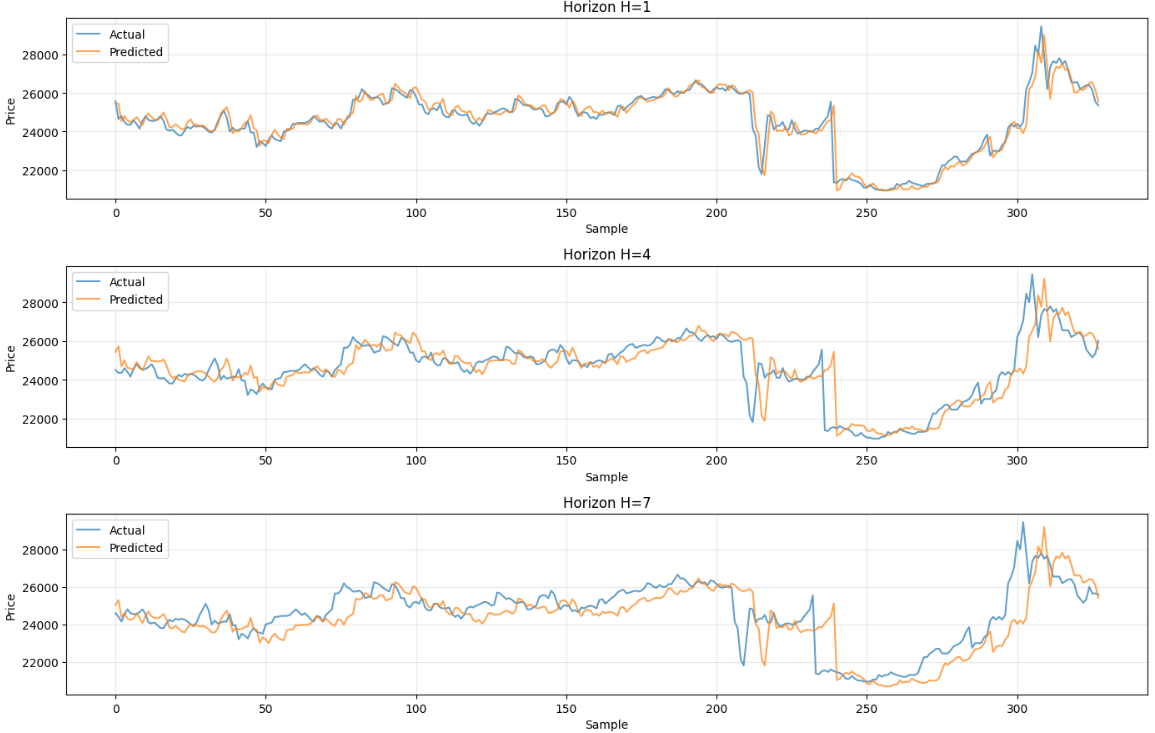


Figure 59: Actual vs predicted closing prices (iTransformer\_VN\_Doc\_Emb\_CrsAtt) across multiple forecasting horizons (H=1,4,7)

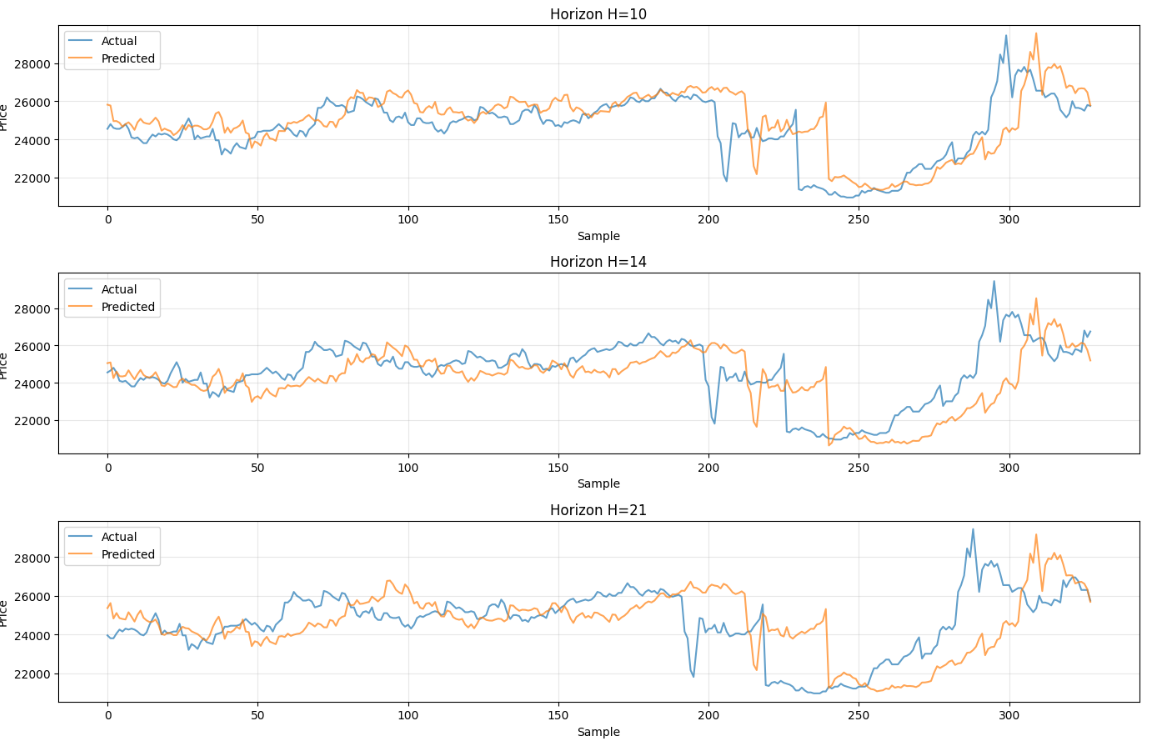


Figure 60: Actual vs predicted closing prices (iTransformer\_VN\_Doc\_Emb\_CrsAtt) across multiple forecasting horizons (H=10,14,21)

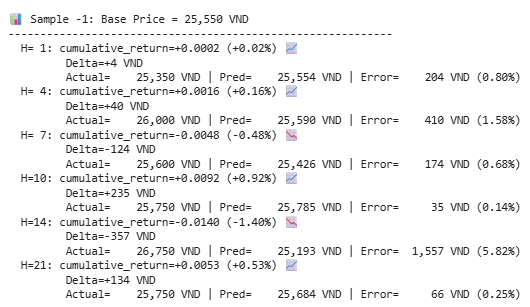


Figure 61: Multi-horizon stock price prediction on a test sample (iTransformer\_VN\_Doc\_Emb\_CrsAtt)

### Concatenate Fusion

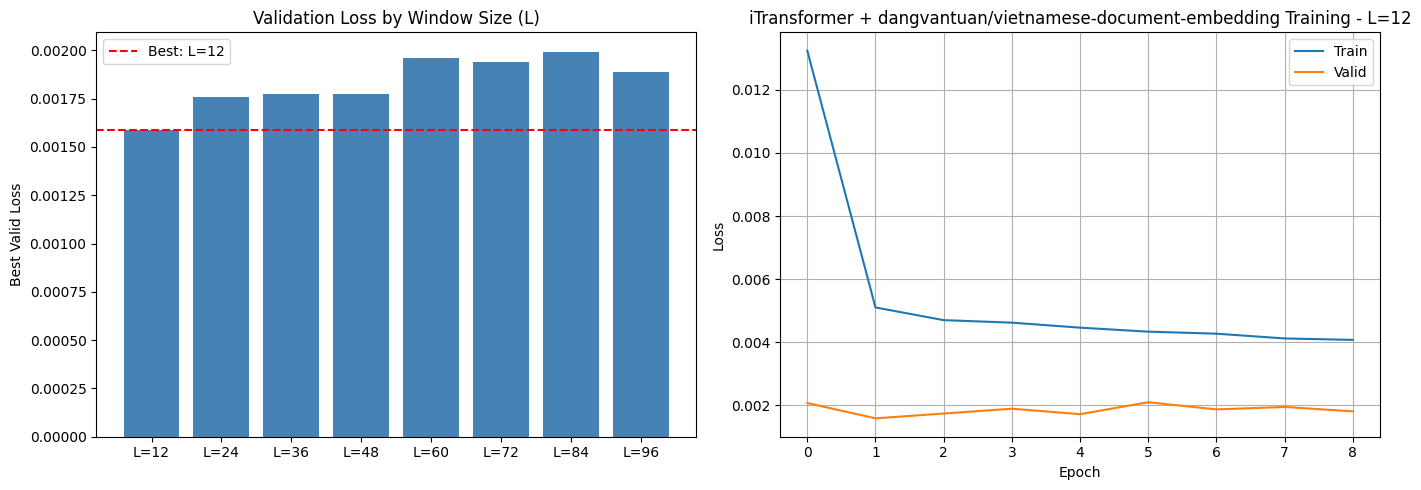


Figure 62: Validation Loss by Window Size and Training Curves of iTransformer\_VN\_Doc\_Emb\_Concat

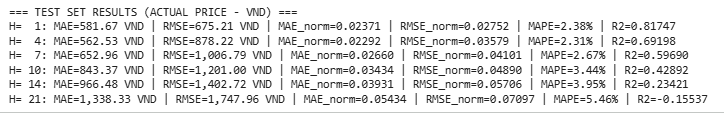


Figure 63: Test Set Results of iTransformer\_VN\_Doc\_Emb\_Concat

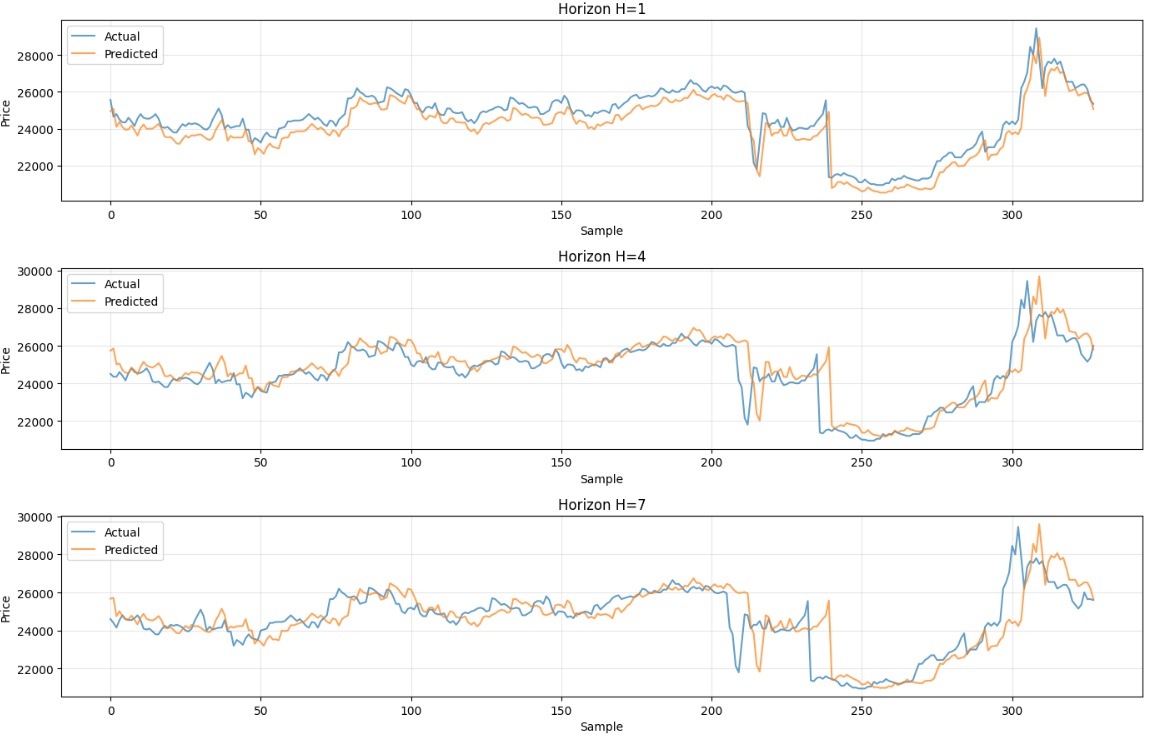


Figure 64: Actual vs predicted closing prices (iTransformer\_VN\_Doc\_Emb\_Concat) across multiple forecasting horizons (H=1,4,7)

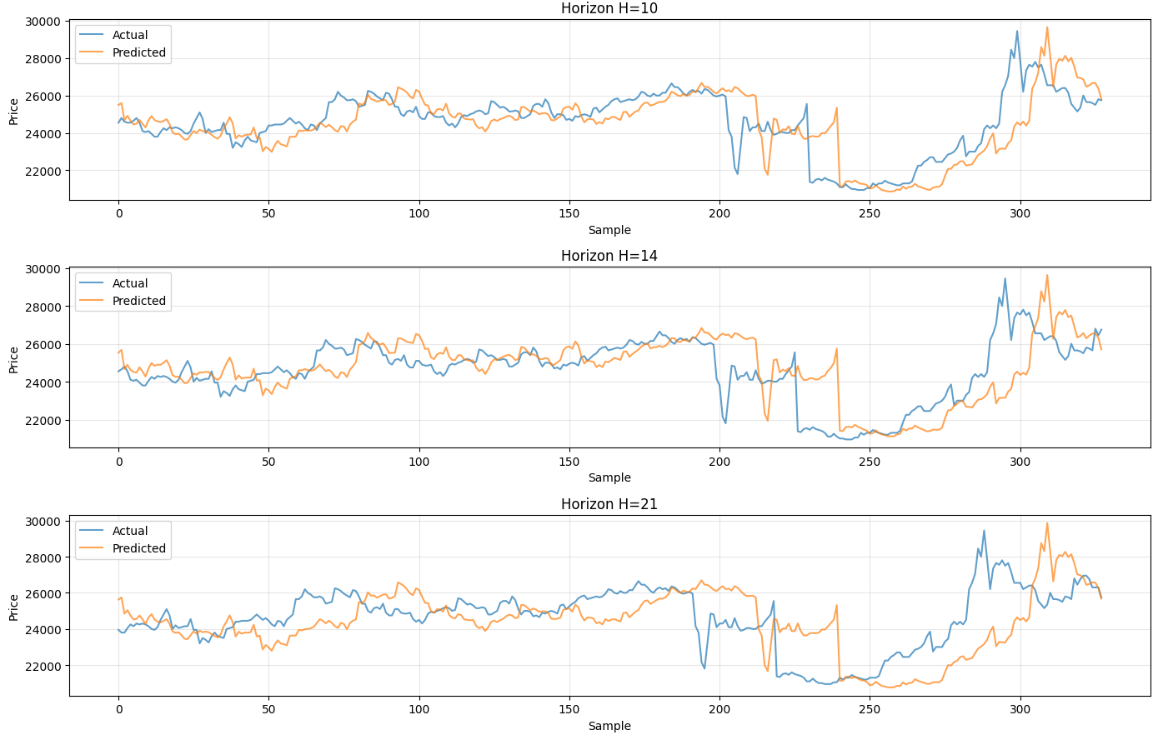


Figure 65: Actual vs predicted closing prices (iTransformer\_VN\_Doc\_Emb\_Concat) across multiple forecasting horizons (H=10,14,21)

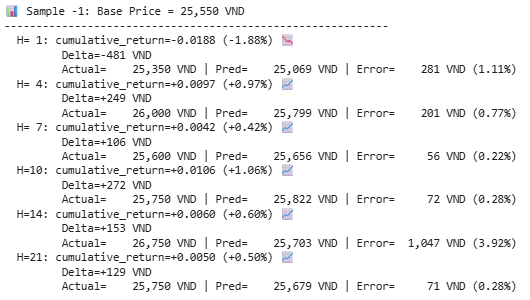


Figure 66: Multi-horizon stock price prediction on a test sample (iTransformer\_VN\_Doc\_Emb\_Concat)